PHYSICAL GROWTH FROM BIRTH TO TWO YEARS: I. STATURE

By

HOWARD V. MEREDITH, Ph.D.

PSY
LIBRARY
RESEARCH

UNIVERSITY OF IOWA STUDIES: STUDIES IN CHILD WELFARE

Volume XIX

S.C.E.R.T., West Bengal
Library
Calcutta
25/3, B. C. Road

Bureau Ednl. Psy. Research
DAVID HA… TRAINING COLLEGE
Dated 11. 4. 59.
Accs. No 1370

FOREWORD

Vast quantities of data relating to the stature of the young child have been published in North America during the past two decades. While some studies are purely normative, the majority are directed toward special problems involving the influence of extrinsic variables on growth. In order to collate these materials, and to make available the wealth of additional information that derives from their comparison with one another, Dr. Meredith has prepared this present summary and critical appraisal.

Part I presents an analysis of data relevant to eleven specific problems of stature. Among these are secular change, sex, socio-economic and race differences, and the effects of illness and dietary treatments. Dr. Meredith has given careful consideration to the reliability of group differences and to the adequacy of comparative norms. He has stated clearly and succinctly what conclusions may be drawn from presently available data.

Part II is an annotated bibliography of all studies, published in North America from 1850 through 1941, that give data on stature during the first two years of life. Two things should make this bibliography uniquely useful to future investigators. First, it contains abstracts of a large number of studies not ordinarily obtainable because of their age or the fugitive character of their publication medium. Second, *for every investigation*, the data on stature have been converted to a common scale of reference. In some instances this has necessitated conversion from one unit to another, and in others it has required careful measurement from graphic presentations of the data. The summary tables at the end of the volume bring together all available measures of both central tendency and variability in a form permitting comparison of studies relating to each of the problems discussed in Part I.

ROBERT R. SEARS

Office of the Director,
Iowa Child Welfare Research Station,
September 1, 1943.

RESEARCH

S.C.E.R.T., West Bengal
Date 11..4..59
Acc. No 1370

ACKNOWLEDGMENTS

This monograph is dedicated to Richard E. Scammon, a scholar unsurpassed in the form of research it represents. For more than a decade Professor Scammon has been arduously at work on an encyclopedic collation of scientific materials pertaining to physical growth. When completed and published, his study will extend to several volumes.

During the two years the present monograph has been in preparation the assistance of more than a score of co-workers has been sought and gratefully received. Special acknowledgment is made to E. Matilda Meredith and Jack L. Goodman, for substantial aid on numerous occasions during execution of the study, and to Robert R. Sears, Virginia B. Knott, and Leon Festinger, for reading the manuscript and offering valuable suggestions.

BUREAU OF EDNL. & PSY. RESEARCH
LIBRARY

PAGE
Differences among seriatim records for individual infants . . 54
  Absolute stature 55
  Rate of growth in stature 62
  Association between absolute stature and rate of gain in stature 68

Stature of infants born prematurely 69
  Menstrual age under 37 weeks 70
  Birth weight below 2500 grams 72
  Stature at birth less than 47 centimeters 74

Relationships between stature and disease 75
  Celiac disease 75
  Diabetes mellitus 76
  Eczema 77
  Gastrointestinal disorders 79
  Respiratory infections 81
  Rickets 83
  Scurvy 85
  Heart abnormality, infected tonsils and adenoids, marasmus, obesity, tetany, tuberculosis 87

Stature in relation to diet 91
  Source and form of milk 91
  Amount and medium of supplementary vitamin D . . . 97
  Supplements of the vitamin B complex, thiamine, and minerals 105
  Prescribed and supervised dietaries 111

PART II: ANNOTATED BIBLIOGRAPHY ON INFANT STATURE COVERING STUDIES MADE IN NORTH AMERICA PRIOR TO 1942 . . 113

INDEX OF NAMES 239

SUBJECT INDEX 249

APPENDIX: TWENTY-THREE TABLES DISPLAYING CENTRAL TENDENCY AND VARIABILITY VALUES FOR STATURE AT NINE INFANCY AGES

INTRODUCTION

Advancement of scientific knowledge pertaining to the physical growth of the child necessitates the cumulative interplay of two forms of research activity. One form centers in the accumulation and analysis of original anthropometric data; the other focuses upon compilation and synthesis of existing studies.

When the problem under consideration is one for which only a paucity of previous investigations is available, the two forms may be readily incorporated in the same research report. Here, then, it can be considered obligatory that each investigator review the earlier literature on the problem, describe the subjects and procedures used in his experiment, present his experimental results, align these results with those from the earlier studies, and formulate a statement of summary and conclusions which fully depicts the status of the problem.

In the event the quantity of research literature in a given area is extensive, the task of adequately including both forms of research in the same report becomes unwieldy and highly time-consuming. *One* consequence of this is that many investigations are reported, each of which essentially constitutes a descriptive account of the collection and statistical reduction of a single sample of original data. These investigations either entirely exclude citation of previous findings on the problem, or make comparisons among only a small number of the relevant investigations.

A *second,* and concomitant, consequence lies in the development of a need for studies which place primary emphasis on collation and synthesis. As a research area expands, the need for publications intended to integrate the entire gamut of available contributions on a particular problem or sector of knowledge becomes increasingly crucial. Functions of this type of research report are: a) to bring together, in conveniently usable form, all the accumulated information accessible on the topic under consideration; b) to afford, through orderly arrangement and appraisement of the materials amassed, a quantitative foundation able to support

CONTENTS

PAGE

FOREWORD iii

ACKNOWLEDGMENTS v

INTRODUCTION 1

Purpose 2

Items of procedure 3

PART I: SYNTHESIS OF NORTH AMERICAN RESEARCH ON STATURE IN INFANCY 1850-1941 7

Average stature: Overall view 10

Secular differences 11

Racial differences 16
- White and Negro comparisons 18
- White infants compared with infants of other racial stocks 19
- Comparison of White subgroups 20
- Negro infants compared with infants of southeast European descent 22

Geographic differences 24

Socio-economic differences 27
- Relationship between socio-economic status and stature at birth 28
- Socio-economic status in relation to stature at ages three months to two years 29
- Relationship between socio-economic status and rate of growth in stature 33
- Stature of socio-economic groups in relation to systematic health guidance 34

Differences with parity, age, and stature of mother 38

Sex differences 41
- Absolute stature, central tendency 41
- Absolute stature, variability 44
- Rate of growth, stature increments 49

more precise statements of fact and less equivocal generalizations than could be expected from any casually assembled subgroup of the studies employed; and c) to discover, through the alignment of results from diversified experiments not previously placed in juxtaposition, new items of knowledge.

PURPOSE

The central objective of the present monograph is to afford a comprehensive review and synthesis of one readily delimitable segment of the research literature on physical growth during infancy. Concisely, the segment treated encompasses the problems, procedures, and findings from investigations on infant stature made in North America prior to 1942.

The presentation is bipartile. Part I supplies a *synthesis* of the information that has accrued from North American research on "stature in infancy" during the period 1850 through 1941. Part II presents an *annotated bibliography* on infant stature which draws upon 130 different studies executed in North America prior to 1942.

In Part I closely related findings are gathered together, organized, and exhibited in a manner to portray the degree of association between stature in infancy and such variables as sex, race, time, socio-economic status, geographic region, stature of parents, order of birth, prematurity, disease, and diet. Special consideration is given to the stature growth of the individual infant—to individual difference in size at specified ages and in gain over designated age intervals. Through the combined use of intercomparison and critical evaluation, an attempt is made a) to epitomize the more substantial knowledge on stature during infancy, and b) to delineate or suggest a number of problems awaiting exploration or needing additional investigation.

Part II constitutes a compilation of the source materials upon which Part I is based. Materials pertaining to the stature of infants are reviewed from nine investigations published before 1900, seventeen investigations published from 1900 to 1920, and one hundred four investigations completed between 1921 and 1941, inclusive. Attention is given to the size and leading characteristics of each sample, to the anthropometric technique through which its data were obtained, to the procedure followed in subdivision of the data for analysis, and to the statistical media employed in deriving and presenting the results. Whenever possible, numerical values are reproduced for a) central tendency and variability of stature at a selected series of ages, b) central tendency and variability of increase in stature between certain ages, c) seriatim stature measurements, or increments, on individual infants, and d) correlation of stature with nonanthropometric variables and with stature of parents, siblings and other relatives. The sequence of the investigations is alphabetical.

ITEMS OF PROCEDURE

1. The scope of the study is restricted anthropometrically to stature, chronologically to the first two postnatal years, geographically to North American research, and secularly to investigations reported before 1942. These restrictions should not be overlooked. They circumscribe the frame of reference within which the findings and conclusions are claimed to hold.

Active recognition of the bounds of the study will require vigilance. The vitamin D content of infant diets should not be inferred to have an influence on girth of arm, or width of head, paralleling that found for stature. A demonstrated relationship in infancy between stature and race should not be accepted as also obtaining at adolescence or during adult life. The average stature of two-year-old White infants living in any stated decade should not be regarded as necessarily identical for North America and Europe, or for North America and Australia. These illustrations are sufficiently coarse that each unwarranted generalization is immediately apparent. On many occasions, however, valid interpretation of the text will require more discriminating recognition of the frame of reference. For instance, whenever it is stated that a certain value is the largest or smallest on record, the statement must be read as specific not only for stature at the age under consideration, but as specific for studies reported prior to 1942 on infants residing in North America.

2. As far as possible, figures for magnitude of stature are reproduced at birth, at one month, at three months and each subsequent quarterly age to eighteen months, and at twenty-four months. No effort has been spared in obtaining values at this series of ages wherever practicable. Occasionally investigations that did not

afford central tendency or variability constants at these ages presented original measurements (Maresh and Washburn, 1938) or frequency distributions (Woodbury, 1921) from which they could be calculated. In a few instances, values at ages near those selected were accepted for annotation (Part II) and then subjected to correction before being used comparatively (Part I and Tables Ia to IXc of the appendix.) For example, stature means at ages twelve, twenty-eight and forty weeks from a study by Bakwin, Bakwin and Milgram (1934) are reproduced in Part II. Prior to use in Part I and inclusion in the comparative tables of the appendix, these means were corrected by graphic interpolation to represent ages three, six and nine months respectively.

3. Frequent use is made of direct quotation. In general, two guiding principles determine whether or not material is presented in the exact language of an author. First, any descriptive passage with reference to a sample, procedure, or finding which is considered reasonably definitive, yet sufficiently succinct for review purposes, is retained in verbatim form. Secondly, statements regarded as needlessly inexact, incomplete, or lacking in clarity are placed within quotation marks. This device facilitates utilization of the maximum information afforded, at the same time making it evident to the reader that the ambiguity is chargeable to the original report. Instances include a sample of "about twenty babies," a nutritional regimen described only to the extent that "the vitamin requirements for growth were satisfied," and an experimental procedure continued with different members of a group "for periods varying from 6 weeks to 1 year."

4. Careful attention is given to specifications regarding orientation of the subject(s) for measurement and rigorousness of anthropometric technique. Many studies fail to make any mention of the manner in which stature was measured, while only a small number are reasonably explicit.

During the first nine months after birth it can be assumed that infants are measured in the recumbent position. However, after the infant is able to maintain the erect position, such an inference becomes untenable. Add to this the fact that the typical infant is known to yield a stature appreciably greater when in dorsal recumbency than when standing (Shinn, 1893; Hall, 1896; Wilson, Sweeny, Stutsman, Chesire and Hatt, 1930; Palmer, 1932), and the importance of specifying the procedure followed with infants one year of age or older becomes apparent. Among those who do indicate the position of the subject, it will be seen that there are wide variations in practice. Stature is taken "recumbent" to age two years by Peatman and Higgons (1938), Stuart (1934), and Wallis (1931); "reclining during the first eighteen months, afterwards standing" by Bayley and Davis (1935), Meredith (1935), and Boynton (1936); recumbent during the first year and later erect "against a wall" by Shinn (1893); recumbent during the first year and at later ages erect but "not against a wall" by Simmons and Todd (1938); reclining prior to one year and erect at later ages by Swanson (1926); and reclining on infants "too young to stand," then erect against a board by Rude (1922).

Similarly, it will be found that only a meager number of studies specify a) the instrument employed—tape, anthropometer or especially constructed measuring board or table; b) the care taken in extending the subject's lower extremities and placing his head with the tragion-orbitale plane at right angles to the long axis of the body; or c) the reliability of the measurements obtained. Chapin (1894) seemingly gives the earliest description of an instrument especially designed for measuring infant stature. Bakwin and Bakwin (1931) claim to have found a measuring board of the same general type to be "more accurate" than an anthropometer. Regarding the careful collection of data and estimation of reliability, Rude (1922) obtained two measurements on each subject; Wallis (1931) took repeated measurements "until agreement was reached at two consecutive readings"; and Stuart (1934) accepted the mean of measurements by two anthropometrists if they agreed within 0.5 cm., otherwise, the mean of four measurements; Bayley and Davis (1935) and Davenport (1938) each made indirect approaches to reliability, while Cates and Goodwin (1936) and Meredith and Goodman (1941) contributed different types of data relating directly to reliability.

5. In describing samples, subgroups, and procedures, attention is frequently called to pertinent omissions. No attempt is made to be exhaustive in this respect. For any particular study the citation of items not discussed is largely confined to variants that would appear either to condition markedly any statement of results, or to vitiate completely the possibility of drawing meaningful conclusions.

With reference to sex, a notation is not made on every occasion where a report fails either to segregate the measurements for males and females, or to show that the amount of data on each sex is roughly equivalent. Rather, it should be assumed that information on sex proportions is incorporated wherever available, and findings specific for sex are reproduced in every instance where an investigation affords separate analyses for male and female infants.

6. Wherever possible, the tabulations of Part II which present central tendency and/or variability values, carry a column giving the limits of each age group, and also a column showing the number of infants measured within each pair of age-group limits. These two columns should be viewed jointly. To illustrate: Bayley and Davis (1935) and Wallis (1931) each report central tendency and variability values representing age two years derived from measurement of twenty-four male infants. For the latter study the age group extended from eighteen months to thirty months, while for the former the limits were only "a few days" above and below twenty-four months. It need not be labored that with samples of infant stature otherwise comparable, judgments of numerical adequacy should take into account age-group homogeneity as well as size *per se*.

7. It may be assumed as beyond reasonable doubt that for every study affording central tendency values the measure employed was either the arithmetic mean or the median. For those studies specifying utilization of one or the other, the mean will be found to predominate. Many studies use only the general term "average." Opportunely, it has been found (Stuart, 1934; Meredith, unpublished) that there is no systematic difference at the infancy ages between mean stature and median stature.

Throughout Part II the central tendency terminology follows that employed in each report annotated. In the comparative tabulations and tables of Part I and the appendix, means, medians, and "averages" are treated as equivalent values.

PART I

SYNTHESIS OF NORTH AMERICAN RESEARCH ON STATURE IN INFANCY 1850-1941

The first step taken in preparing to synthesize the information amassed in Part II was that of compiling Tables Ia to IXc. These tables (given in the appendix) afford an ordered display of central tendency and variability values for absolute stature at selected ages. The tables numerically designated I cover the neonatal ages between birth and two weeks; those numbered II to IX represent, in sequence, one month of age, the six successive quarterly ages from three to eighteen months, and age two years. From the standpoint of content, the tables fall into three groups. There is an "a" group giving central tendency values for male and female infants combined, a "b" group furnishing central tendency values for males and females separately, and a "c" group in which values relating to variability are systematized. At ages one and fifteen months, the limited number of figures accessible made it feasible to incorporate the "a," "b," and "c" content in single tables (Tables II and VII).

An aggregate of 336 averages for infants of both sexes is shown in Tables Ia, II, IIIa, IVa, Va, VIa, VII, VIIIa and IXa. Each average is supplemented with an itemization of the major characteristics of the sample from which it was obtained.

Averages on 281 groups of male infants and 254 groups of female infants are presented in Tables Ib, II, IIIb, IVb, Vb, VIb, VII, VIIIb and IXb. Here, also, reference is made to the salient features of each sample.

In Tables Ic, II, IIIc, IVc, Vc, VIc, VII, VIIIc and IXc, variability figures are exhibited for males, for females, and for both sexes together. Included are 230 standard deviations, a like number of coefficients of variation, and 554 other values from which may be read 88 interquartile zones (seventy-fifth percentile minus twenty-fifth percentile), 57 distances between the tenth and ninetieth percentiles, and the full range of 132 distributions (maximum value minus minimum value.)

The tables are self-explanatory throughout, except that they presuppose a reading of the Introduction and unstinted reference to the more complete descriptions for many samples given in Part II.

AVERAGE STATURE: OVERALL VIEW

Leading questions: For the particular territorial zone and temporal period encompassed in the present monograph, and taking into account the entire series of analyses for stature available on nonpathologic infants at each of several ages, around what points do the central tendency values cluster and over what zones do they extend? More explicitly, on the assumption that at different infancy ages *distributions for average stature* have been compiled utilizing all studies made in North America during the years 1850 through 1941 (with the exception of investigations for subjects having gross defects or showing clinical symptoms of illness),

a. What figure may be taken as a close estimate of the parameter or "true" value of average stature at birth? What figures at ages three, six, nine, twelve, eighteen and twenty-four months, respectively?

b. How wide is the dispersion or spread of the averages at each of these ages? What is the span of the values which delimit the central one-half of the different series of averages?

At each of the seven ages specified, the requisite distributions were accessible in Tables Ia, IIIa, IVa, Va, VIa, VIIIa and IXa. These tables were constructed using only averages derived from measurements on both male and female infants, and arranging the averages for each age in ascending order of magnitude without regard to variables such as racial descent, socio-economic status, geographic locality, decade during which the data was collected, or dietary of the subjects. Among all the available materials for each age from Part II, the only averages excluded were those for infants with specific diseases and those, at ages younger than eighteen months, for infants born prematurely.

Statistical reduction of the distributions given in Tables Ia, IIIa, IVa, Va, VIa, VIIIa and IXa yields the following tabulation:

CENTRAL TENDENCY AND VARIABILITY VALUES (cm.) FOR AVERAGE STATURE

Age (mos.)	Number of Averages	Median Value (Both sexes)	Percentiles 25th	Percentiles 75th	Range of Averages
Birth	31	50.2	49.7	50.5	48.4-53.9
3	41	60.0	59.4	60.7	55.2-62.3
6	50	66.4	64.9	66.8	59.8-68.0
9	40	70.9	66.9	71.5	65.1-73.5
12	51	74.6	73.1	75.5	68.5-78.3
18	38	79.4	77.5	81.3	72.4-82.9
24	42	85.3	83.5	87.4	79.9-88.5

Findings which accrue are:

1. Central tendency values of 50.2 cm. at birth, 60.0 cm. at three months, 66.4 cm. at six months, 74.6 cm. at one year, and 85.3 cm. at two years.
2. Increases in central tendency of 24.4 cm. between birth and one year, 10.7 cm. between one and two years, and 35.1 cm. (practically 70 per cent) between birth and two years.
3. Differences between the limits within which the central one-half of the averages lie of 0.8 cm. at birth, 1.3 cm. at three months, 1.9 cm. at six months, 2.4 cm. at one year, and 3.9 cm. at two years.
4. Differences between the minimum and maximum averages reported of 5.5 cm. at birth, 7.1 cm. at three months, 8.2 cm. at six months, 9.8 cm. at one year, and 8.6 cm. at two years.
5. Overlapping of the distributions for every adjacent age from three months to two years. The highest three averages at age eighteen months exceed 15 per cent of the averages for two years, and the lowest three averages at eighteen months are exceeded by over 35 per cent of the averages for one year.

SECULAR DIFFERENCES

Leading questions: For North America, are there appreciable differences in average stature between infants born around 1880, 1900, 1920 and 1940? If so, has the secular trend for infant stature been one of progressive increase, continual decrease, or fluctuation?

In considering this problem, the frame of reference was restricted to studies of non-pathologic, White infants. Specifically, samples for infants born prematurely or showing definite symptoms of disease were rejected, while samples for "predominantly White" infants and those considered "probably White" were included.

Employing Tables Ia, IIIa, IVa, VIa, VIIIa and IXa, composite averages at each of six ages were secured for the periods a) 1850 through 1909, b) 1910 through 1925, and c) 1926 through 1941. In classification of the acceptable values for a given age according to the period in which the data were collected, an attempt was made to avoid duplicate use of records. To illustrate: At birth, the Bakwin and Bakwin (1934) subanalyses by ethnic group and the Baldwin (1921) analysis for a portion of the Woodbury (1921) sample were excluded; at one year, the Francis (1940) analysis using part of the Simmons and Todd (1938) sample and the Woodbury (1921) subanalyses by race and region were omitted.

In obtaining composite averages for the periods 1910-25 and 1926-41, the procedure was as follows: Specific for age and period, each average was multiplied by the number of cases on which it was based, and the sum of the products divided by the sum of the cases.[1] For the period prior to 1910, at all ages above three months, the mean of the available averages was computed. This procedure appeared preferable since for two of the three samples studied at ages six months and one year, and for one of the major studies at eighteen months, the numbers of cases were not reported. The investigations pooled at each age are enumerated below.

a. At birth (parturition to the sixth postnatal day): For the period 1850-1909, Chapin (1894), Holt (1897), Meyer (1915), Riggs (1904) and Stockton-Hough (1885); for the period 1910-25, Adair and Scammon (1921), Benedict and Talbot (1915), Montague and Hollingworth (1914), Taylor (1919) and Woodbury (1921); for the period 1926-41, Bakwin and Bakwin (1934), Boyd (1941), Gunstad and Treloar (1936), Meredith and Brown (1937),

---

[1] In mathematic symbolism, the formula used was

$$M_c = \frac{N_1 M_1 + N_2 M_2 + \ldots + N_r M_r}{N_1 + N_2 + \ldots + N_r}$$

in which M represents arithmetic mean, N represents number of measures, subscript c refers to a combined or composite sample, and the numerical subscripts designate component samples.

Meredith and Goodman (1941), Simmons and Todd (1938), Stebbins (1933), Stuart (1934) and Tiber (1930).

b. At three months: For the period 1850-1909, Chapin (1894); for the period 1910-25, Baldwin, Fillmore and Hadley (1930), Benedict and Talbot (1921), Freeman (1914), Grover (1915), Richdorf (1925), Rude (1922) and Woodbury (1921); for the period 1926-41, Bakwin, Bakwin and Milgram (1934), Bayley and Davis (1935), Blatt, Harris, Jacobs and Zeldes (1940), Elias and Turner (1936), Freeman (1933), Gesell and Thompson (1938), Hamil, Reynolds, Poole and Macy (1938), Jeans and Stearns (1938), Law and Frederick (1938), Maresh and Washburn (1938), Meredith (1940), Peatman and Higgons (1938), Simmons and Todd (1938) and Stuart (1934).

c. At six months: In addition to all of the studies listed at three months, Chaille (1887), Fleischner (1906) and Holt (1897) for the period 1850-1909; Crum (1916), Hess (1916) and Macy (1912) for the period 1910-25; Blatt and Schapiro (1935) and Boyd (1941) for the period 1926-41.

d. At one year: The same series of investigations as at six months, except that averages were not available in four instances (Blatt, Harris, Jacobs and Zeldes, 1940; Jeans and Stearns, 1938; Law and Frederick, 1938; and Richdorf, 1925), and there were two additional studies for the period 1926-41 (Davenport, 1938; Wallis, 1931).

e. At eighteen months: For the period 1850-1909, Chapin (1894), Holt (1897) and Peckham (1882); for the period 1910-25, Baldwin, Fillmore and Hadley (1930), Benedict and Talbot (1921), Crum (1916), Gebhart (1924), Grover (1915), Hess (1916), Macy (1912), Rude (1922) and Woodbury (1921); for the period 1926-41, Bayley and Davis (1935), Blatt and Schapiro (1935), Boyd (1941), Freeman (1933), Maresh and Washburn (1938), Meredith (1940), Mohr and Bartelme (1934), Peatman and Higgons (1938), Simmons and Todd (1938) and Stuart (1934).

f. At two years: The same series as at one year, with the exception of five omissions (Baldwin, Fillmore and Hadley 1930; Chapin, 1894; Gebhart, 1924; Hess, 1916; Peckham, 1882), three additions for the period 1910-25 (Blatt, 1921; Freeman, 1914; Johnson, 1925), and a single addition for the period 1926-41 (Wallis, 1931).

COMPOSITE STATURE AVERAGES (cm.) FOR WHITE INFANTS OF THREE PERIODS

	1850-1909		*1910-1925*		*1926-1941*	
Age (mos.)	Number of Cases	Mean	Number of Cases (Both sexes)	Mean	Number of Cases	Mean
Birth	2973	49.9	2567	50.4	5123	50.4
3	27	56.6	7336	60.5	2062	60.2
6	Over 100	62.1	8102	66.2	1981	66.7
12	Over 100	70.3	7316	73.2	1714	75.3
18	Over 100	75.6	5751	79.3	1004	81.5
24	?	82.8	5955	84.2	1050	87.0

In interpreting this tabulation, the following facts should be taken into account:

a. For the period 1850-1909, only one study was available at age three months and one at age two years. Moreover, the former utilized infants considered "malnourished" and the latter "healthy" infants probably measured in private practice.

b. At ages one year, eighteen months, and two years, the pooled sample for the period 1926-41 is heavily weighted with infants of North European ancestry and of the "above average" to "upper" socio-economic levels. The samples for the period 1910-25 more nearly typify the whole gamut of White stocks and North American socio-economic groups.

Giving concurrent consideration to both the composite averages and selected individual studies, four major findings on secular variation may be listed:

1. Averages for stature on White infants living in North America during the 1890's are lower than comparable averages on infants living half a century later. The magnitude of the difference is markedly less for neonates than for infants one to two years of age.

2. At birth, the composite averages are identical for the periods 1910-25 and 1926-41, and lower by 0.5 cm. for the period 1850-1909. The difference between the two periods 1850-1909 and 1910-41 (0.5 cm.) may tenably be regarded as statistically significant.[2] Turning to discrete studies, Stockton-Hough (1885) and Bakwin and Bakwin (1934) afford analyses on large samples drawn at

---

[2] On the assumption that the standard deviation of the stature distribution for newborn infants in each period was even as high at 2.5 cm. (see pp. 45-6) an obtained difference in means of 0.2 cm. would warrant rejection of the null hypothesis at the 1 per cent level of confidence.

widely separated times, yet seemingly comparable otherwise. The average obtained by the latter from over 1600 White infants born in New York around 1930 is 1.5 cm. higher than that obtained by the former on a sample of approximately 700 White infants born sixty years previously in Pennsylvania.

3. At six months, the composite average for the years 1926-41 is higher by 0.5 cm. than that for the preceding period. Compared with the composite average for the period 1850-1909, that for the years 1910-25 is larger by 4.1 cm. and that for the years 1926-41 larger by 4.6 cm. Except for factors operating differentially with time, the individual studies of Holt (1897), Crum (1916), and Peatman and Higgons (1938) appear roughly similar. Peatman and Higgons' records were accumulated in private pediatric practice, those of Crum at baby contests and health conferences, and those of Holt probably in private pediatric practice. The focal years represented may be taken as 1890, 1915 and 1935. Holt's average is 2.4 cm. lower than Crum's and 3.3 cm. lower than that of Peatman and Higgons.

4. At eighteen months, the composite averages are greater for 1910-25 than for 1850-1909 by 3.7 cm. and greater for 1926-41 than for 1910-25 by 2.2 cm. Highly comparable individual studies widely spaced in time are those of Peckham (1882), Woodbury (1921) and Stuart (1934). Peckham's group consisted of 61 infants, predominantly of German ancestry, measured about 1880; Woodbury's of 111 infants of German ancestry measured 1918-19; and Stuart's of 78 infants, mainly of Irish ancestry, measured during the early 1930's. Stuart's average exceeds Woodbury's by 2.4 cm. and Peckham's by 6.6 cm.

On the whole, the direction of the secular trend for stature in infancy has been upward. It is well established that the typical North American, White infant was shorter in the decade 1880-90 than in the decade 1930-40. With regard to amount of increase, this has been less for neonates than for older infants. At birth the typical infant of 1880-90 was apparently about 0.5 cm. (one-fifth of an inch) shorter than the infant of 1930-40. At ages one to two years, it appears a sound generalization that the typical infant was no less than 1.5 cm. taller in 1940 than in 1915, and no less than 2.5 cm. taller in 1915 than in 1880. It follows that the average two-year-old child may be taken as at least four centimeters (one and one-half inches) taller for 1940 than for 1880.

RACIAL DIFFERENCES

Leading questions: Were there differences in stature among White, Negroid and Mongoloid infants living in North America 1850-1941? Did infants of northwest European descent differ in stature from those of southeast European ancestry? Are there any materials from the racial or ethnic groups studied in North America 1850-1941 indicative of the extent to which differences in stature during infancy are genetically determined and the extent to which stature is modifiable through changes in the environment?

Answers to these questions were sought in an integration of relevant findings at consecutive semiannual ages from birth to two years. The method was principally that of obtaining composite averages for various ancestral groups and subjecting these to alignment and intercomparison. In deriving each composite average, the procedure was the same as that employed in the previous section in deriving the composite averages for the secular periods 1910-25 and 1926-41 (*i.e.*, the average of every component group was multiplied by the number of cases in that group, and the sum of the products divided by the total number of subjects for all the component groups).

Viewed with reference to an amount of information which could be considered reasonably adequate, the available data relating to racial differences are decidedly limited. In an anthropological framework presupposing comparable findings on North American infants of the "major" racial groups, (Mongoloid, Negroid, and White), of the "composite" groups (*e.g.*, American Indian, Eskimo, Mulatto), and of at least the "White" subgroups (*e.g.*, Armenoid, Nordic, Mediterranean), there are gaps yet to be filled and areas in which only coarse approximations are accessible. A single study is available on Mongoloid infants (Japanese). The "Negro" studies unquestionably include large numbers of infants with appreciable amounts of White admixture. Only four studies are on infants of "composite" groups (two for Eskimos and the other two for Indians). The White subdivisions are racio-geographic or ethnic, not strictly racial. That is, in no instance were infants, or their parents, typed as having the morphologic characteristics of Nordics, Alpines, Dinarics and so forth. Rather, they were grouped as of "Scandinavian" ancestry or "Italian" descent or "North European" lineage or "Central European" stocks.

Averages for Negro and White infants were assembled as follows:

a. For White infants, from the tabulation presented and described in the section on secular differences.

b. For Negro infants, from the studies by Freeman and Platt (1932); Meyer (1915); Poole, Hamil, Cooley and Macy (1938); Rhoads, Rapoport, Kennedy and Stokes (1941); Riggs (1904) and Woodbury (1921).

Averages for White subgroups were obtained using these studies:

a. For infants of northwest European ancestry (chiefly British Isles, Netherlands, Germany and Scandinavian countries), Bakwin and Bakwin (1934); Baldwin, Fillmore and Hadley (1930); Crum (1916); Gesell and Thompson (1938); Maresh and Washburn (1938); Meredith (1940); Meredith and Brown (1937); Richdorf (1925); Simmons and Todd (1938); Stuart (1934); Taylor (1919) and Woodbury (1921).

b. For infants of southeast European ancestry ("Mediterranean" and "Central European" countries at birth; at older ages, Italy exclusively), Bakwin and Bakwin (1934), Gebhart (1924), Montague and Hollingworth (1914) and Woodbury (1921).

AVERAGES FOR STATURE (cm.) BY ETHNIC GROUP, SECULAR PERIOD, AND AGE

	Major racial groups				White subgroups			
Period	WHITE		NEGRO		S.E. EUROPE		N.W. EUROPE	
	Cases	Mean	Cases	Mean	Cases	Mean	Cases	Mean
				Birth				
1850-1909	2973	49.9	1748	48.5				
1910-1925	2567	50.4			2000	50.2	250	50.6
1926-1941	5123	50.4	47	49.1*	297	49.5	1504	50.4
				6 months				
1910-1925	8102	66.2	279	64.6	820	64.3	886	66.5
1926-1941	1981	66.7	99	66.2*			674	66.7
				12 months				
1910-1925	7316	73.2	182	71.3	559	71.4	873	73.7
1926-1941	1714	75.3	145	75.0†			702	75.3
				18 months				
1910-1925	5751	79.3	146	77.4	514	77.3	646	79.8
1926-1941	1004	81.5	99	81.2*			640	81.8
				24 months				
1910-1925	5955	84.2	373	82.3	1129	81.5	1066	85.1
1926-1941	1050	87.0	99	86.4*			611	87.2

*Males only.

†Only 21 female cases included.

The findings from this tabulation appear best drawn in conjunction with findings from other pertinent analyses. Comparisons will be made between a) White and Negro infants, b) White infants and infants of other racial stocks, c) White infants of northwest European lineage and of southeast European lineage, d) Negro infants and infants of southeast European descent.

White and Negro comparisons

1. At birth, the stature of White infants exceeds that of Negro infants. For the period 1850-1909, the average from 1748 Negro infants is 1.4 cm. lower than that from 2973 White infants. For the period 1926-41, the only Negro average available is for a group of 47 male infants. This is 0.4 cm. lower than the average on 116 White males born at the same hospital, and 1.3 cm. lower than the composite average on 5123 White infants of both sexes.

Christie, Dunham, Jenss and Dippel (1941) compared percentage figures for White and Negro infants of different stature classes. Their data were collected 1936-38 "in the ward service of Johns Hopkins Hospital" on infants "born alive . . . nonsyphilitic" and from single pregnancies. Of 563 White cases, 14.4 per cent measured less than 47.0 cm., and 42.6 per cent 50.0 cm. or more. Corresponding percentages for 544 Negro cases were 26.1 and 20.2, respectively. Peckham (1938) analysed stature data accumulated between 1896 and 1935 on 2162 "theoretically viable" infants from single pregnancies, each measuring "less than 45 cm. in length . . . but weighing at least 1500 gm." It was found that 30.8 per cent of the records were for White infants and the remaining 69.2 per cent for Negro infants.

2. At ages six months to two years, White infants are taller than Negro infants in the period 1910-25, while in the period 1926-41 the relationship is indefinite. The foregoing tabulation shows the Negro averages for 1910-25 to be lower than the White averages by 1.6 cm. at six months and by 1.9 cm. at older ages.

Averages for Negro infants in the period 1926-41 are available from Poole, Hamil, Cooley and Macy (1938) at a single age, and from Rhoads, Rapoport, Kennedy and Stokes (1941) on one sex. From approximately one month after birth to one year of age, Poole, Hamil, Cooley and Macy prescribed and supervised the dietary of 147 Detroit infants (101 White and 46 Negro) of the "indigent or near-indigent class." At one year, the average stature of the White cases was 75.9 cm. and that of the Negro cases 76.5 cm. The Negro figure is *higher* than the composite figure for White infants measured 1926-41 by 1.2 cm. Rhoads, Rapoport, Kennedy and Stokes (1941) similarly prescribed and supervised the dietary of 233 male infants (134 White and 99 Negro) drawn largely from "lower income groups" of Philadelphia. At six months of age the White and Negro averages were equal (66.2 cm.), at one year the Negro average (74.8 cm.) exceeded the White by 0.5 cm., and at two years, the Negro average (86.4 cm.) was the higher by 0.6 cm. At all ages, these figures for Negro males are *lower* than the 1926-41 composite averages for White infants.[3]

White infants compared with infants of other racial stocks

1. An average neonatal stature of 49.8 cm. was reported by Ito (1936) on 202 infants of Japanese ancestry born in California during the years 1932-35. The 1926-41 composite figure for White infants is higher by 0.6 cm. Assuming standard deviations as high as 2.2 cm. in each instance, a significance ratio is obtained which clearly exceeds the critical value required for confidence at the 1 per cent level. On the hypothesis of random sampling, it may be inferred as practically certain that the sampling of Mongoloid infants was drawn from a different (shorter) population than the sampling of White infants.

Bakwin and Bakwin's (1934) average for New York White infants of Mediterranean nationalities is 49.5 cm., or 0.3 cm. lower than Ito's, while Meredith and Brown's (1937) average for Iowa infants of northwest European ethnic groups (drawn mainly from the lower classes, as were Ito's cases) is 50.5 cm., or 0.7 cm. higher.

---

[3] Since this monograph went to press, Michelson (*Amer. J. Phys. Anthrop.*, 1943, 30, 191-213) has published an analysis of stature data on 661 Negro infants between the postnatal ages of three weeks and twenty-four months, measured at "the Department of Health Clinics in Harlem, New York City, in the year 1936" (p. 202). The subjects were "under the dietary and general supervision of the Department of Health of the City of New York in the years 1935-1936" (p. 205). For both sexes combined, mean stature was 60.0 cm. at three months, 67.0 cm. at six months, 74.7 cm. at one year and 80.8 cm. at eighteen months. Compared with the composite averages for White infants examined 1926-41, these values are similar for three months and six months and lower for one year and eighteen months. It will be noted that for Negro infants one year of age, there is a discrepancy of 2.0 cm. between the mean from Michelson and that from Poole, Hamil, Cooley and Macy. Using the significance ratio, t, (i.e., taking cognizance of the size and variance of the samples as well as their discrepancy in central tendency) the proposition that these two distributions of Negro stature were drawn from the same population may be disclaimed at the 1 per cent level of confidence.

2. Small samples of full-blood American Indians were studied by Hrdlicka (1908) and Wissler (1911). The former reported measurements obtained during the second postnatal year on nine infants of the Pima and Apache tribes examined between 1898 and 1905. On the average, these infants were 2.3 cm. below the composite averages on White infants for the period 1850-1909 and 5.0 cm. below those for the period 1910-25. The data presented by Wissler were on six full-blood infants of the "Ogallala subdivision of the Teton." One record was taken at age one year and the remaining five records at age two years. Compared with the composite White averages for 1850-1909, the single record at one year was higher by 9.2 cm. and the average of the five records at two years higher by 2.4 cm. Correspondingly, the White averages for 1910-25 were exceeded by 6.3 cm. and 1.0 cm. respectively. It is of interest that these studies, although using samples of only six and nine subjects, suggest that marked differences in average stature between various American Indian groups may obtain as early in postnatal life as the second year.

3. A study by Hrdlicka (1941) reproduced stature measurements obtained between 1928 and 1931 on six Eskimo infants living in the "Kuskokwin region," Alaska, under "semicivilized" conditions. The infants were between the ages of one and two years. Without overlooking the limited size of the sample, it may be noted that, as a group, these infants are shorter than any other group of North American infants studied. A single record of stature on an Eskimo male infant measured in 1846 was reported by Sutherland.[4] The record (71.1 cm.) was made during study of a tribe of over 100 individuals living at "Kinnooksook, Hogarth Sound, Cumberland Strait." The infant was apparently between one and two years of age.

Comparison of White subgroups

1. At birth, although the available materials cannot be considered conclusive, infants of southeast European ancestry appear slightly shorter than infants of northwest European ancestry. For

---

[4] Sutherland, P. C. 1856 On the Esquimaux. J. Ethnol. Soc. London, 4, 193-214.

the period 1926-41, the 1504 cases of northwest European descent yield an average 0.9 cm. higher than that from Bakwin and Bakwin's (1934) 297 cases representing "Mediterranean" and "Central European" groups. This dissimilarity in stature appears reasonably interpreted as too large to be attributed solely to chance variation from random sampling.[5]

The difference at birth between the averages tabulated for the period 1910-25 is small (0.4 cm.) and more equivocal. The studies under comparison here are those of Montague and Hollingworth (1914) with southeast European stocks predominating, and of Taylor (1919) with northwest European stocks predominating. While these investigations are similar for socio-economic status, the former is based on data taken "immediately after birth" and the latter on data obtained largely at the postnatal ages of four to six days.

2. At ages six months to two years, and for the period 1910-25, the typical infant of Italian ancestry is markedly shorter than the typical infant of northwest European ancestry. The magnitude of the difference is 2.2 cm. at six months, 2.3 cm. at one year, 2.5 cm. at eighteen months, and 3.6 cm. at two years. At eighteen months the subjects of Italian descent represent a somewhat lower socio-economic level than those of northwest European descent. This is no doubt also true at other ages. The question arises, what portion of the differences should be considered as possibly registering the operation of socio-economic variables? Well-grounded consideration of this question must be held in abeyance until socio-economic differences have been systematically treated. Here, it will merely be stated without support that when ample allowance is made for socio-economic selection the infants of Italian descent remain shorter than those of northwest European descent by upwards of 1.0 cm. at six months and by more than 1.5 cm. at eighteen months.

For the period 1926-41, there is a complete absence of studies on infants of southeast European ancestry, although averages on upwards of 600 cases at each age can be calculated for infants of northwest European lineage. Comparison of the latter with averages from the total series of White infants examined 1926-41, shows

---

[5] Given practically 1800 degrees of freedom, an obtained difference in means of 0.9 cm., and standard deviations each estimated at 2.2 cm., the significance ratio is more than double the required value for rejection of the null hypothesis at the 1 per cent level of confidence.

S.C.E.R.T., West Bengal
Date 11..4..59
Acc. No. 1370
S.C.E.R.T., West Bengal Library

identical values at six months and one year, and practically equivalent values at eighteen months and two years. This is no doubt primarily a reflection of the fact that the 1926-41 samples of White infants included few subjects that were not of northwest European descent. It suggests, however, the possibility that stature differences between infants of southeast and northwest European lineage were not as pronounced in the period 1926-41 as during the period 1910-25.

Negro infants compared with infants of southeast European descent

1. At birth, it appears probable that Negro infants are slightly shorter than infants of southeast European ethnic groups. The average for Negro males measured in New York City by Freeman and Platt (1932) is 0.4 cm. lower than the average for male and female infants of Mediterranean nationalities measured in New York City by Bakwin and Bakwin (1934). Assuming the difference in central tendency to be 0.7 cm. when the two studies are made comparable for sex, and estimating the standard deviations at 2.2 cm., $t=2.0$, indicating a difference in the stature distributions that is statistically significant at the 5 per cent level of confidence.

2. At ages six to eighteen months, Negro infants are apparently no shorter than infants of Italian descent. Specifically, the total samples on each group for the period 1910-25 yield practically identical averages at ages six, twelve, and eighteen months.

3. At two years of age, Negro infants appear to be slightly taller than infants of Italian ancestry. The available averages are for the period 1910-25. They show infants of "mothers born in Italy" to be shorter than Negro infants by 0.8 cm. Even on the assumption that the standard deviations for these samples equalled the largest reported at two years (4.4 cm.), the difference in stature is statistically significant at the 1 per cent confidence level. There are no grounds for postulating that the socio-economic level was appreciably lower for the Italian sample than for the Negro.

4. The three foregoing paragraphs suggest that the rate of growth during infancy is somewhat higher for Negro infants than for infants of southeast European stocks. In other words, the hypothesis of a slightly different growth tempo for each group appears the most tenable hypothesis for integrating the findings

that comparatively Negro infants are shorter at birth, equivalent at one year, and taller at two years.

Selected Generalizations

Were there differences in stature among White, Negroid and Mongoloid infants living in North America 1850-1941? It is reasonably well established that "at term" White infants exceeded Negro infants in average stature by roughly half an inch. The one average reported on Mongoloid infants lies in an intermediate position.

Did infants of northwest European descent differ in stature from those of southeast European ancestry? The available averages at ages from one to two years fall in the period 1910-25. They show, after a liberal allowance has been made for sampling differences in the socio-economic variable, that infants of northwest European ancestry were no less than half an inch taller than infants of southeast European descent.

Is there any evidence on racial or ethnic groups indicative of the extent to which differences in stature during infancy are genetically determined and the extent to which stature is modifiable through changes in the environment? There is evidence for the period 1910-25 that at ages six months to two years Negro infants were over one-half inch shorter than White infants, while for the period 1926-41 there are two studies of White and Negro infants indicating that given like diets from early infancy Negro infants are no shorter at one and two years of age than are White infants. Whether or not these findings carry any valid implications on the "nature-nurture" question, it is important to recognize that their apparently decisive implications from cursory reading come to necessitate major reservations when carefully examined. To illustrate: It cannot be assumed that the 1910-25 White sample is genetically equivalent to the White groups for 1926-41. The same holds for the Negro infants. Both White groups studied in the period 1926-41 were somewhat more heavily weighted with infants of southeast European ancestry than was the sample for the period 1910-25. This fact must be viewed in relation to the trend of the findings for rate of growth from the comparison of Negro and southeast European infants of similarly low socio-economic status.

Turning more particularly to the Negro samples, genetic differences due to factors of ongoing racial mixture and possible "hybrid vigor" must not be overlooked.

Geographic Differences

Leading question: Are there regional differences in infant stature? That is, holding time, ethnic descent and socio-economic status approximately constant, does the stature of North American infants vary with locality?

Three facets of this question were considered: a) infants living in a coastal region were compared with those of an inland region, b) intercomparison was made among infants residing in widely separated urban communities, and c) infants reared in a rural area were compared with those of nearby urban centers.

In making the coastal *vs.* inland comparison, Woodbury's (1921) averages for California and for Iowa were brought into juxtaposition. Roughly comparable urban samples were afforded by Bayley and Davis (1935) for Berkeley, California; by Meredith (1935) and Boynton (1936) for Iowa City, Iowa; by Simmons and Todd (1938) for Cleveland, Ohio; and by Peatman and Higgons (1938) for Greenwich, Connecticut, Rye, New York, and other towns adjacent. For the rural *vs.* urban comparison, the averages utilized were those of Baldwin, Fillmore and Hadley (1930) on rural infants of east-central Iowa and those published by the Iowa Child Welfare Research Station (1931) on urban infants of the same region.

AVERAGES FOR STATURE (cm.) FROM INFANTS LIVING IN DIFFERENT GEOGRAPHIC REGIONS

(Subjects mainly of northwest European descent and upper classes)

Period 1926-41

Age (mos.)	*Iowa City* Cases	*Iowa City* Mean	*Berkeley* Cases	*Berkeley* Mean	*Greenwich Rye, et al.* Cases	*Greenwich Rye, et al.* Mean	*Cleveland* Cases	*Cleveland* Mean
3	98	60.9	61	60.7	343	60.9	253	60.4
6	210	67.2	58	67.5	303	67.5	279	66.4
9	263	71.6	56	71.6	238	72.2	292	71.2
12	253	75.5	56	75.7	296	75.5	302	75.2
18	192	82.5	47	82.0	214	81.5	301	81.4
24	175	87.8	43	87.4	209	87.3	322	86.8

	California		*Iowa*		*Rural Iowa*		*Urban Iowa*	
	(Subjects mainly of northwest European ancestry)							
	Period 1918-19				Period 1920-29			
(mos.)	Cases	Mean	Cases	Mean	Cases	Mean	Cases	Mean
3	674	60.7	1486	60.9	33	60.5	34	60.9
6	782	66.7	1510	66.7				
9	755	70.9	1437	70.6	60	70.2	94	71.4
12	740	74.0	1489	73.5	59	73.6	98	74.6
18	548	80.0	1213	79.3	56	80.0	72	80.9
24	538	84.3	1213	84.6				

From this tabulation it follows:

1. There is no systematic difference in average stature either between the infants of California and Iowa measured in 1918-19, or between the infants of Berkeley and Iowa City measured during the decade 1926-35. Compared with the averages for Iowa, the California averages are slightly higher at nine, twelve, and eighteen months, equal at six months, and lower at three and twenty-four months. Compared with the Berkeley figures, the Iowa City figures are slightly higher at three, eighteen and twenty-four months, equal at nine months, and lower at six and twelve months.

2. There is no systematic difference in average stature between the age-group samples for Berkeley (or those for Iowa City) and the age-group samples for Rye, Greenwich, and other towns in close proximity. The averages for the Connecticut and New York towns coincide with those for Iowa City at three months, for Berkeley at six months, for Iowa City at one year, and for Berkeley at two years. The Iowa City and Berkeley values are each below the Connecticut and New York value at nine months and above that at eighteen months.

3. The infants of Cleveland show a consistent tendency to be slightly smaller in average stature than the infants of Berkeley, Iowa City, and the Connecticut-New York towns. On the whole, the differences are smallest at three and twelve months and most marked at six and twenty-four months. Averaging the differences for all six ages, the Cleveland group is shorter than the Iowa City group by 0.7 cm. and shorter than the two other groups by 0.6 cm.

Reference to the characteristics of the Cleveland sample gives no indication that it was less favorably selected than the samples with which it is compared. It was drawn over a later period than the Berkeley and Iowa City samples, the socio-economic level was apparently higher than for Iowa City and at least as high as for the other groups, and the ancestry was "with few exceptions . . . North European." After one year of age, the Cleveland infants were measured erect and "not against a wall." While this technique would yield a slightly shorter stature than measurements obtained in dorsal recumbency (New York-Connecticut towns) or measurements taken erect against a wall (Iowa City), it would not aid in explaining the shorter stature during the first year.

The Cleveland averages are similar to those from Maresh and Washburn (1938) for infants of Denver, Colorado. In both studies the lineage was almost completely northwest European and the data were collected between 1931 and 1937. The percentage of cases from the professional and managerial classes is given as around 30 for the Denver sample and over 80 for the Cleveland sample. From the standpoint of density of population,[6] Cleveland and Denver are more alike than Cleveland and Iowa City, or Cleveland and Greenwich, Connecticut.

4. The averages for infants living in rural localities of east-central Iowa are consistently lower than those for infants living in urban areas of the same geographic region. Over the age period from nine to eighteen months, the average difference between the trends of central tendency approximates 1.0 cm. However, at no age does t equal the value required for statistical significance at the 1 per cent level of confidence.

The urban infants were not described with respect to socio-economic selection or density of population. They were probably from towns and small cities, and possibly represented a somewhat above average socio-economic level.

Summarily, the average stature of North American infants appears not to be different for otherwise comparable samples drawn in California, Iowa, and New York. This generalization must be regarded as specific for these localities and for the types of samples drawn. As yet, studies are available for relatively few geographic regions and adequately comprehensive intercomparisons cannot be made.

---

[6] Several investigators reporting studies at the school ages have inferred that in large cities growth in stature may be retarded as a consequence of the proximity and height of buildings (reduction of sunlight), the gaseous by-products of heating, manufacture and crowding (impurity of air), and other plausibly "inhibitory influences."

There is fragmentary evidence suggesting that infants living in rural areas and in large cities tend to be slightly shorter than infants residing in towns of moderate size. This should not be interpreted as more than a research lead awaiting substantial investigation.

Socio-economic Differences

Leading questions: What is the relationship between the stature of neonates and the socio-economic status of their parents? Are one-year-old infants of the indigent classes shorter than those of the managerial groups? Do infants of the professional classes gain in stature at a faster rate than infants of the unskilled groups? Is the rate of stature growth different for infants of the lower classes whose parents do not receive regular health and nutritional guidance than for those whose parents enroll with a free developmental clinic and endeavor to carry out the dietary program and other health-care recommendations prescribed? These questions are conveniently considered in the same order as stated.

As a preface, it will be helpful to give brief consideration to the nature and measurement of socio-economic status. First, socio-economic status is not a rigorously defined concept; rather, it is a loose, commonplace term which on different occasions carries a variety of meanings. Rarely do investigators comment upon its scope or, more pertinently, discuss from the standpoint of the problem they are studying the particular variables it is considered to represent. This does not imply that the concept has not been found useful, or that it is too amorphous to discuss with reference to different problems. There would be general agreement that in any gross association between socio-economic status and stature, socio-economic status probably encompasses differential constellations of such variables as diet, housing conditions, health practices, and selective mating.

Secondly, socio-economic status is not a heterogeneous construct that is measured from study to study with a single standardized instrument. Different investigators estimate or characterize it through information on such items as occupation of the father, family income, resources of the home, and type of neighborhood. In presenting their information, some employ one typifying statement or value (*e.g.*, "of the better class," "mean annual income of $670''), while others classify their data in from two to seven categories and give the proportion in each category (*e.g.*, fathers 30 per cent unskilled, 50 per cent skilled, 20 per cent in managerial or professional vocations).

There seems little doubt that as more intensive study is made of the relationships between physical growth and many of the plausibly differential variables symbolized by socio-economic status, the concept will be outgrown and replaced by less complex concepts that are more amenable to definition and measurement.

In the ensuing treatment of research on infants of varying socio-economic levels, frequent reference will be made to groups representing the lower, middle, and upper classes. The term ''lower'' will be found to apply to samples drawn from ''congested'' districts, ''poverty-stricken'' neighborhoods, ''city public hospital'' wards, ''very poor'' homes, the ''indigent and near-indigent'' groups, homes having annual incomes mainly between $600 and $1100, the ''lower income'' groups, and homes predominantly of ''factory laboring people.'' The term ''middle'' refers to groups described as ''mainly middle class,'' ''near the average level,'' at ''the middle socio-economic status with respect to occupation, schooling, avocational interests, and home equipment,'' from homes with ''moderate incomes,'' and from families having an annual income around $1700. The term ''upper'' encompasses samples drawn from ''the favored class,'' the ''superior'' socio-economic level, the ''professional and managerial'' groups, homes having a median annual income of approximately $3300, homes ''of moderate prosperity rather than wealth,'' and infants examined in private obstetric and pediatric practice.

Relationship between socio-economic status and stature at birth

Does the average stature of newborn infants from the unskilled and semiskilled groups exceed, equal, or fall below the average for infants of the skilled, managerial and professional groups? The available studies do not yield an answer to the question which can take the form of a choice of one of the three alternatives. In part, the question may be answered by elimination. There are extensive amounts of material indicating that the average stature of neonates of the lower classes *does not exceed* the average for infants of the middle and upper classes. On the reduced question—that of whether stature at birth shows *no systematic variation* with socio-economic level, or is *greater* for the middle and upper classes than for the lower classes—the evidence is ambivalent.

1. Bakwin and Bakwin (1934) reported averages of 50.4 cm. for 470 male infants of a "poverty-stricken" group and 51.2 cm. for 205 male infants of a "moderate income" group. This difference of 0.8 cm. was substantiated from separate analyses on both "first-born" and "later-born" male infants. In each instance the significance ratio was found to exceed the critical value required for confident rejection of the null hypothesis (in this case, the hypothesis that the two socio-economic populations sampled were alike in stature) at the 1 per cent level.

2. Employing male records for 435 "city public hospital" newborns and 447 "private" newborns, Gunstad and Treloar (1936) obtained identical averages (50.9 cm.). Their averages for female infants were 49.8 cm. from 427 ward records and 50.1 cm. from 458 records on private patients. The significance ratio for females was 1.79, less than the ratio of 1.96 needed for statistical significance at the 5 per cent level.

3. Gunstad and Treloar's findings are corroborated by composite averages. For 2102 neonates of both sexes drawn mainly from the lower socio-economic groups (Stebbins, 1933; Gunstad and Treloar, 1936; Meredith and Brown, 1937; Meredith and Goodman, 1941) average stature is the same as for 1122 neonates of both sexes representing the middle and upper socio-economic groups (Adair and Scammon, 1921; Gunstad and Treloar, 1936; Simmons and Todd, 1938). The mean is 50.4 cm. in each instance. It will be noted that the Gunstad and Treloar data are included in the composite values, while the Bakwin and Bakwin data—being for male infants exclusively—are not.

Socio-economic status in relation to stature at ages three months to two years.

For the age interval from three months to two years, are infants of the professional and managerial classes taller than those of the indigent and near-indigent classes? If so, what is the magnitude of the difference at several representative ages? The tabulation which follows aligns four series of averages culled from Tables IIIa, IVa, Va, VIa, VIIIa, and IXa. All four series are based on data for infants measured over the years 1927-39. One is for White infants ("mainly of Irish descent") living in a "poverty-stricken" district of New York City. The other three are for infants of northwest European ancestry; one on subjects of "middle socio-economic status" residing in New Haven, Connecticut, another on Cleveland subjects from the professional and managerial groups, and the third on Iowa City subjects from the professional and managerial groups.

AVERAGES FOR STATURE (cm.) ON WHITE INFANTS OF SELECTED SOCIO-ECONOMIC LEVELS

	Lower Classes		*Middle Classes*		*Upper Classes*			
	Bakwin, Bakwin, and Milgram (1934)		Gesell and Thompson (1938)		Simmons and Todd (1938)		Meredith (1940)	
Age (mos.)	Cases	Mean	Cases	Mean	Cases	Mean	Cases	Mean
				Both Sexes				
3	130	58.3	25	60.7	253	60.4	105	61.0
6	74	64.9	37	66.7	279	66.4	191	67.4
9	62	69.9	37	71.3	292	71.2	210	72.1
12	52	73.4	43	74.7	302	75.2	207	76.1
18					301	81.4	202	82.7
24					322	86.8	177	88.1

Merging the contents of this tabulation with other relevant materials, it is found:

1. The central tendency values from studies on the upper classes are not in close agreement. Compared with the Meredith (1940) averages, those of Simmons and Todd (1938) are lower at every age. The mean difference is 1.0 cm. It is not apparent what variables are operating to produce this difference. In each instance the data were collected during the decade 1930-39 on infants of northwest European ancestry whose parents were engaged in professional or managerial occupations and were willing to bring their infants to a laboratory for repeated developmental examination. To infer that the Cleveland infants probably represent a less extreme segment of the distribution for socio-economic status than that represented by the Iowa City infants appears no more warranted than the reverse inference. In this connection it is pertinent to note that Simmons and Todd appraise their group as being "as well cared for and as uniformly nourished as any group likely to be drawn from the extra-institutional population." During the second year, there is a slight difference between the

studies in anthropometric technique (the Iowa City sample being measured erect and against a wall, the Cleveland sample erect but not against a wall). There is also the marked dissimilarity in density of population between Cleveland and Iowa City.

Two samples heavily weighted with infants from the professional and managerial classes, though not drawn exclusively from these groups, are those of Bayley and Davis (1935) and of Peatman and Higgons (1938). Referred to the studies of Simmons and Todd and of Meredith, the Bayley and Davis averages are intermediate throughout. The averages from Peatman and Higgons (reported to represent infants receiving reasonably optimal pediatric supervision) are practically identical with the Meredith averages at three, six, and nine months, but barely higher than the Simmons and Todd averages at one and two years.

2. It is questionable whether any sample for which stature data have been analysed can be considered to typify the central parameter of the socio-economic distribution. Samples predominantly representing the middle classes are those of Gesell and Thompson (1938), Maresh and Washburn (1938), Bakwin, Bakwin and Milgram (1934), Stuart (1934) and Rude (1922). Gesell and Thompson's infants came from families "near the average level." There was some selection in that a) "several cases of decided malnutrition were excluded," and b) the parents of those included were willing to enroll in a seriatim examination program. The Maresh and Washburn sample, although drawn largely from the middle socio-economic levels, carried a moderate weighting of infants from the professional and managerial classes. Compared with the Gesell and Thompson values (see foregoing tabulation), the Maresh and Washburn averages are 0.8 cm. lower at three months, around 0.3 cm. lower at six and nine months, and similar at one year.

The averages from the "middle class" and "moderate income" groups presented by Stuart and by Bakwin, Bakwin and Milgram cannot be taken as typical for these groups. In both instances the records were accumulated on infants whose parents received guidance on diet and health care through a pediatric clinic. Stuart's values are practically identical with those of Maresh and Washburn at all ages from three months to two years. Over the age span from six months to one year, the Bakwin, Bakwin and Milgram values exceed those of Stuart by 1.0 cm. or more, and are but slightly smaller than those of Meredith for infants of the professional and managerial classes exclusively.

Rude's data were collected in 1918—more than a decade earlier than those of the four other samples drawn largely from the middle socio-economic groups. Two-thirds of the parents were foreign-born (of Slavic ancestry) and had an annual income below $1500. Referred to Stuart's averages, those of Rude are 1.6 cm. lower at six months, 2.9 cm. lower at one year, and 4.6 cm. lower at two years. It is obvious that the apparently small socio-economic difference between the studies of Stuart and Rude is somewhat masked by racial dissimiliarity and overshadowed by secular variation. Rude's values at six, nine, and twelve months are actually lower by 0.4 cm., 1.0 cm., and 1.6 cm. respectively, than those of Bakwin, Bakwin and Milgram (1934) collected between about 1929 and 1934 on infants of a "poverty-stricken" district.

3. At all ages from three months to two years, average stature is less for infants of the lower classes than for those of the upper classes. Compared with the Meredith (1940) averages for infants of the professional and managerial groups, the Bakwin, Bakwin and Milgram (1934) values for infants from "very poor homes" (infants of parents having an annual income below $1000 and failing to avail themselves of free health guidance and diet supplements obtainable at a nearby "well-baby clinic") were lower by 2.7 cm. at three months, 2.5 cm. at six months, 2.2 cm. at nine months, and 2.7 cm. at twelve months. With reference to the Simmons and Todd (1938) values at three, six, nine, and twelve months, the parallel figures from Bakwin, Bakwin and Milgram are lower by 2.1 cm., 1.5 cm., 1.3 cm., and 1.8 cm., respectively. The mean of this series of differences is 1.7 cm., that of the preceding series 2.5 cm.

At two years of age, an average for stature on 25 White female infants of a low income group is available from Wise (1941). These infants were measured at WPA nursery schools in the vicinity of Birmingham, Alabama, and were from homes having a mean annual income of $670. In comparison with the female averages at age two years from Meredith and from Simmons and Todd, the Wise value is lower by 2.1 cm. and 1.1 cm., respectively. While the samples of Wise and of Simmons and Todd do not yield a significance ratio large enough to support the inference that they were drawn from dissimilar populations, the difference between the samples of Wise and Meredith is statistically significant at the 1 per cent level of confidence ($t=2.9$).

On the whole, it would appear that for the age span from three months to two years the difference in average stature between infants representing the two relatively small terminal segments of the distribution for socio-economic status approximates two centimeters. That this statement should be interpreted as no more than a *tentative* epitome of the limited materials presented in the two preceding paragraphs will be given reenforcement in the next section. Manifestly, the studies on the lower classes are too few to support a reasonably dependable generalization on the constancy or variation of the difference from age to age.

Relationship between socio-economic status and rate of growth in stature

Stature increments covering successive age periods from birth to one or two years were obtained by Meredith (1941) on ten infants of the professional and managerial classes (four males, six females) and eight infants of the unskilled and semiskilled groups (six males, two females). The subjects were all Iowa City residents of northwest European ancestry living in their own homes. Since the object of the study was to describe (not experimentally to modify) the growth of infants of different socio-economic levels, no pressure was brought upon the parents to participate in any program of nutritional or health care. Extraordinary precautions were taken to secure highly reliable data.

AVERAGE GAIN IN STATURE (cm.) OF INFANTS OF TWO SOCIO-ECONOMIC GROUPS

Group	Number	Birth to 3 mos.	3 to 6 mos.	6 to 9 mos.	9 to 12 mos.	Birth to 12 mos.
		Both sexes				
Professional & managerial	10	10.5	6.6	4.6	3.7	25.4
Unskilled & semiskilled	8	10.3	6.4	4.5	3.5	24.7
		Males				
Professional & managerial	4	10.8	7.2	4.9	3.8	26.7
Unskilled & semiskilled	6	10.5	6.8	4.5	3.4	25.2

That the differences between the paired means are consistent in direction is apparent. The greater magnitude of the differences for males indicates that the differences for both sexes together would have been larger had the ratio of males to females been the same in both socio-economic groups. Two of the male infants from the professional and managerial classes and three of those from the semiskilled and unskilled classes were followed to two years. The mean gains—birth to two years— were 41.1 cm. for the former and 37.3 cm. (3.8 cm. lower) for the latter.

It is axiomatic that the finding of larger increments for infants representing the upper classes than for infants representing the lower classes, implies a progressive divergence of the two groups in absolute stature. The comparisons on absolute stature made in the previous section tend to corroborate this divergence between birth and three months but not between three months and two years. It will be recalled that from alignment of the Simmons and Todd (1938) and Meredith (1940) averages with those of Bakwin, Bakwin and Milgram (1934) and Wise (1941), there was no indication that the magnitude of the difference in stature between the upper and lower socio-economic groups was greater at one year than at three months, or greater at two years than at one year. This question of the extent to which stature trends for the extreme socio-economic groups diverge or run parallel over the period from three months to two years must await clarification through further research. As pointed out previously, the amount of requisite information available for the lower classes is conspicuously insufficient.

Stature of socio-economic groups in relation to systematic health guidance

It has already been noted that socio-economic status is a broad, somewhat amorphous concept which, from the standpoint of physical growth, possibly relates to varying constellations of such items as nutrition, sanitation, immunization, health habits, and selective mating. Having found, then, that one-year-old infants of the indigent and semiskilled groups are about two centimeters shorter in average stature than infants of the professional and managerial groups, the question presents itself: How much can this difference be reduced by attempting to equalize certain items (*e.g.*, diet and health practices) while not subjecting other items (*e.g.*, selective mating and housing) to experimental modification? Concretely, what is the magnitude of the difference in average stature between infants living in poverty-stricken areas whose parents receive regular guidance regarding their dietary and health care, and infants of the professional classes?

In the tabulation which follows, eight series of averages for male infants (more series were available for males than for both sexes) are placed in juxtaposition. Six of the series represent male infants of the lower, middle, and upper classes whose parents received seriatim advice relative to their infant's diet schedule and health program. One series each is for male infants of non-advised parents residing in a "poverty-stricken" district, and male infants of the professional and managerial classes drawn without reference to health and nutritional procedures. All eight series are reproduced from Tables IIIb, IVb, Vb, VIb, VIIIb, and IXb, and are derived from data largely accumulated between 1930 and 1940.

AVERAGES (cm.) FOR MALE INFANTS VARYING IN SOCIO-ECONOMIC LEVEL AND HEALTH CARE

	Lower Classes							
	Bakwin, Bakwin, and Milgram (1934)				Rhoads, Rapoport, Kennedy and Stokes (1941)		Raiford (1938)	
	Non-clinic		Clinic					
	White				White and Negro			
Age (mos.)	Cases	Mean	Cases	Mean	Cases	Mean	Cases	Mean
3	78	58.9	93	60.5	233	59.2	240	60.8
6	42	65.3	54	67.5	233	66.2	209	67.8
9	36	70.3	36	71.8	233	70.9	175	72.5
12	27	73.8	22	76.1	233	74.5	136	76.6
18					233	80.9		
24					233	86.1		

	Middle Classes				Upper Classes			
	Stuart (1934)		Bakwin, Bakwin, and Milgram (1934)		Peatman and Higgons (1938)		Meredith (1940)	
	White							
3	50	60.8	117	60.3	183	61.5	63	61.8
6	44	67.1	85	67.8	156	68.6	105	68.4
9	42	71.5	60	72.7	122	73.2	109	73.0
12	38	75.7	31	76.9	144	76.7	114	77.1
18	34	82.4			108	82.0	101	83.5
24	26	88.5			101	88.1	105	88.9

This tabulation shows:

1. The average stature for infants of the lower classes given "improved care" over the first year of postnatal life is greater than that for those under non-improved care. For the age period six to twelve months, the values reported by Bakwin, Bakwin and Milgram (1934) on New York City males living in "very poor homes" are higher by around two centimeters for those enrolled with the Bellevue "well baby clinic" than for those not attending the clinic. At the clinic, in addition to advice regarding diet and health care, cod liver oil was "distributed freely at the pharmacy," and some families were "aided with milk and occasionally with other foods."

Male averages covering the latter half of the first year from Raiford (1938) and from Rhoads, Rapoport, Kennedy and Stokes (1941) exceed those for Bakwin, Bakwin and Milgram's non-advised sample by 2.5 cm. and 0.7 cm. respectively. Raiford's cases were drawn from the indigent and near-indigent classes of Detroit. They were prescribed "balanced diets" and continually supervised. Beginning at about five weeks of age, the dietary consisted of "evaporated milk, water and corn syrup acidified by the addition of commercially dehydrated lemon juice powder." The majority were given vitamin D supplement. Cereal was added during the fifth month, strained carrots and peas during the sixth, prune pulp and apple sauce during the seventh. The Rhoads, Rapoport, Kennedy and Stokes subjects, drawn largely from "lower income groups" of Philadelphia, were prescribed evaporated milk, orange or tomato juice, and vitamin D (one-third of the group 1500 U.S.P. units daily, two-thirds 110 U.S.P. units daily). "Banana and cereal were started at 3 to 4 months, pureed vegetables and fruits at 5 to 6 months, and meat and potato at 8 to 10 months." The milk and the vitamin supplements (one-sixth of group given added B complex) "were delivered at the homes every two weeks by the nurse and by the social worker."

When the three "improved care" samples are pooled they yield an average stature for the latter half of the first year higher by one and one-half centimeters than that from Bakwin, Bakwin and Milgram's non-clinic sample.

2. For infants given "improved care" throughout the first postnatal year, average stature shows a gross tendency to be greater at the middle and upper socio-economic levels than at the

indigent or near-indigent levels. Combining the data at six, nine, and twelve months, from Stuart (1934), Peatman and Higgons (1938) and Bakwin, Bakwin and Milgram's "moderate income" group, there result average values which exceed those obtained from pooling the three "improved care" samples for the lower classes by slightly more than one centimeter.

Stuart's figures at six, nine, and twelve months (for male infants mainly of the middle classes and all under regular pediatric guidance) average almost one centimeter *lower* than those of Raiford (1938) and almost one centimeter *higher* than those of Rhoads, Rapoport, Kennedy and Stokes (1941). They are *not appreciably different* from those on Bakwin, Bakwin and Milgram's Bellevue Clinic series.

For the Bakwin, Bakwin and Milgram Fifth Avenue Clinic sample (family income around $1700 yearly), the averages at ages six to twelve months are approximately 1.9 cm. *above* those from Rhoads, Rapoport, Kennedy and Stokes, 0.7 cm. *above* those from Bakwin, Bakwin and Milgram's Bellevue Clinic group, and *practically identical* with those from Raiford.

Peatman and Higgons' averages for male infants of the middle and upper classes considered to be receiving "reasonably optimal" pediatric care are *higher* at six and nine months than any of the "improved care" averages for male infants of the lower classes. At one year of age, the averages are *similar* for Peatman and Higgons (annual income over $3000 for 60 per cent of cases, private pediatric practice) and for Raiford (offspring of "factory laboring people of Detroit," fed under the direction of the Children's Fund of Michigan).

3. The data available for the second year of postnatal life are insufficient to warrant generalizations comparable even to those covering the latter half of the first year. At ages eighteen months and two years, the averages from Rhoads, Rapoport, Kennedy and Stokes (1941) were markedly lower than those from Stuart (1934). Stuart's values, however, are slightly higher than those of Peatman and Higgons (1938). In this connection, the difference between the male averages obtained at three months and at two years is 27.7 cm. from Stuart and 26.6 cm. from Peatman and Higgons. For females, corresponding differences are 26.9 cm. and 26.4 cm., respectively.

It should not be overlooked that none of the samples for infants given "improved care" yield averages at eighteen months or two years of higher magnitude than those of Meredith (1940) on infants of the professional and managerial classes. Although many parents of the Meredith group voluntarily secured diet and health care recommendations through a nutrition consultant or through private physicians, the sample was not selected with reference to either source or adequacy of dietary and health procedures.

DIFFERENCES WITH PARITY, AGE, AND STATURE OF MOTHER

Leading questions: Are the infants of primiparae typically shorter at birth than those of multiparae? Is average stature greater for neonates from third pregnancies than for those from second pregnancies, or for fifth-born infants than for infants of third birth order?

Is the stature of the new-born related to maternal age? If so, in view of the fact that the age of a mother increases with the birth order of her children, what is the association between neonatal stature and maternal age with order of birth held constant?

Do the offspring of tall mothers tend to be taller than those of short mothers? More explicitly, is the stature of infants at birth related to the stature of their mothers in early adulthood (*i.e.*, at the time of discharge from hospitalization after parturition)?

Birth order

Averages at birth from six analyses each for first-born infants and for infants of multiparae are shown in Table Ib of the appendix. The direction of the differences is consistent throughout. In every instance the average stature of first-born infants is lower than that for infants of higher birth orders. On the whole, the magnitude of the difference may be taken as 0.6 cm. This is the difference which accrues when the data from the separate analyses are pooled and composite averages obtained for the 2252 infants of primiparae and the 2213 "later-born" infants.

Employing an alternative statistical method, Christie, Dunham, Jenss and Dippel (1941) corroborated the tendency for infants born to primiparae to be shorter than infants of multiparae. In a sample of 563 White neonates, of those who measured less than

47.0 cm. at birth, 64 per cent were first-born, while of those who measured 50.0 cm. or more, 47 per cent were first-born. Benedict and Talbot (1915) reported minimum and maximum values of 46.0 cm. and 54.0 cm. for 38 infants of primiparae and of 46.5 cm. and 54.5 cm. for 61 infants of multiparae.

The studies of Stockton-Hough (1885) and of Meredith and Brown (1937) made more than a dichotomous approach to the problem of birth-order differences. For Stockton-Hough, 423 newborn infants from first pregnancies gave an average stature a) less by 1.0 cm. than that for 156 cases from second pregnancies, b) less by 1.5 cm. than that for 46 cases from third pregnancies, and c) less by 0.4 cm. than that for 87 cases of fourth and higher pregnancy numbers. Meredith and Brown found average stature at birth to be 0.4 cm. lower for 413 first-born infants than for 421 infants of "second, third and fourth birth orders," and 0.4 cm. higher for 206 infants of "fifth birth order and up" than for those of numbers second to fourth inclusive. Of the first-born subjects, 40 per cent measured less than 50.0 cm. and 60 per cent 50.0 cm. or more. Parallel percentages for infants of fifth and higher birth orders were 32 and 68.

Utilizing records on approximately 2300 male neonates, Harris (1926) obtained Pearson product-moment correlation coefficients of .09 for both pregnancy order with stature and birth order with stature. From 2200 female neonates the corresponding estimates of relationship were each −.01. The finding for females of an absence of positive association is inconsistent with the findings for females from Stockton-Hough, Benedict and Talbot, Bakwin and Bakwin (1934), and Meredith and Brown (see Part II). The finding for males of a "very low" positive relationship would probably have been raised a little had the correlation ratio (Eta) been used instead of the product-moment coefficient (r). This follows since there appears to be a slightly curvilinear relationship between neonatal stature and birth order—illustrated in that the difference between first order of birth and second order exceeds that between second and third, and the succeeding differences tend to become progressively smaller up to at least the fifth-born. Since birth order is not normally distributed, the value $r = .09$ cannot be meaningfully interpreted in terms of a standard estimate of error.

Parental age

Meredith and Brown (1937) found a slight tendency for young mothers to give birth to shorter infants than older mothers. For 369 mothers between fifteen and twenty years of age, the birth length of the infants averaged 50.2 cm. Averages from 403 mothers twenty-one to twenty-seven years of age and from 262 mothers twenty-eight to forty-five years of age were 50.6 cm. and 50.8 cm., respectively. The Pearson product-moment coefficient was .09±.03 for maternal age with the stature of male neonates. For maternal age and the stature of female neonates, $r = .10 \pm .03$.

In a study based on records pertaining to roughly 4500 White infants and their parents, Harris (1926) obtained a statistically significant positive association between parental age and the stature of male infants, but not between parental age and the stature of female infants. Specifically, the product-moment coefficients were .10±.02 and .03±.02 for maternal age with male and female stature, .08±.02 and −.02±.02 for paternal age with male and female stature.

On the assumption that low positive relationships exist between parental age and neonatal stature, between birth order and neonatal stature, and between birth order and parental age, the question arises: What is the association between parental age and the stature of infants of a single birth order? Values from Meredith and Brown are $r = -.03 \pm .04$ for maternal age with the stature of first-born males and $r = .05 \pm .05$ for maternal age with stature of first-born females. It appears, then, that there is no relationship between the stature of infants at birth and maternal age *per se* (*i.e.*, when birth order is held constant neonatal stature varies independently of maternal age).

Maternal stature

Findings obtained by Gunstad and Treloar (1936), Meredith and Brown (1937), and Meredith and Goodman (1941) all attest a low positive correlation between the stature of infants at birth and the stature of their mothers in early adulthood. Using a tripartite classification of maternal stature, Meredith and Brown obtained neonatal averages of 50.0 cm., 50.5 cm., and 51.1 cm., respectively. The classes were 122-157 cm., 158-164 cm., and

165-183 cm. In consecutive order, the cases in these classes numbered 271, 363, and 252.

Pearson product-moment coefficients were presented by Gunstad and Treloar, Meredith and Brown, and Meredith and Goodman.

CORRELATION COEFFICIENTS FOR NEWBORN STATURE WITH MATERNAL STATURE

Sex	Gunstad and Treloar				Meredith and Brown				Meredith and Goodman	
	Private		Non-private		Total Series		First-born			
	Cases	r	Cases	r	Cases	r	Cases	r	Cases	r
Males	447	.12	435	.14	481	.17	199	.21	50	.22
Females	458	.15	427	.20	439	.21	152	.23	50	.32

In the terminology of Gunstad and Treloar, this tabulation registers "a real and positive correlation between the length of infants and the stature of their mothers" of an order approximating $r=.20$. It is suggestive that in every instance maternal stature is associated slightly more closely with the stature of female infants than that of male infants.

There is need for studies treating the relation between stature of infants and a) paternal stature, b) mid-parent stature, c) stature of mother in infancy.

Sex Differences

Leading questions: Is the average stature of male infants greater than, less than, or equal to that of female infants? In the event one sex regularly exceeds the other throughout infancy, does the magnitude of the difference increase with age (*e.g.*, do males surpass females by a larger amount at two years of age than at one year, or at one year than at birth)? Is variability in stature the same for both sexes? If not, which sex is the more variable?

Absolute stature, central tendency

Tables Ib, II, IIIb, IVb, Vb, VIb, VII, VIIIb and IXb present 255 paired averages for male and female infants. Of these 240, or 94 per cent, show males to be larger than females. In four instances identical values are reported for both sexes, while in the remaining eleven females exceed males. On inspection of the fifteen couplets not registering a male advantage, it will be seen that in seven instances the size of the samples was less than twenty per sex.

Composite averages for White males and females were obtained at seven infancy ages. The procedure employed was that of multiplying averages for White infants given in Tables Ib, IIIb, IVb, Vb, VIb, VIIIb and IXb by their respective numbers of cases and, specific for age and sex, dividing the sum of the products by the sum of the cases. The studies utilized were as follows:

a. At birth (parturition to the sixth postnatal day): For males only, Freeman and Platt (1932); for males and females, Adair and Scammon (1921), Bakwin and Bakwin (1934), Benedict and Talbot (1915), Boyd (1941), Gunstad and Treloar (1936), Holt (1897), Meredith and Brown (1937), Meredith and Goodman (1941), Montague and Hollingworth (1914), Simmons and Todd (1938), Stebbins (1933), Stockton-Hough (1885), Stuart (1934), Taylor (1919), Tiber (1930) and Woodbury (1921).

b. At three, six, nine, and twelve months: For males only, Rhoads, Rapoport, Kennedy and Stokes (1941); for both sexes, Bakwin, Bakwin and Milgram (1934), Baldwin, Fillmore and Hadley (1930), Bayley and Davis (1935), Benedict and Talbot (1921), Gesell and Thompson (1938), Iowa Child Welfare Research Station (1931), Maresh and Washburn (1938), Meredith (1940), Peatman and Higgons (1938), Rude (1922), Simmons and Todd (1938), Stuart (1934), and Woodbury—total White cases—(1921). Additional studies used at one or more of these ages: For males only, at three, six and nine months, Nelson (1930) and Stearns, Jeans and Vandecar (1936); for females only, at twelve months, Swanson (1926); for both sexes, Richdorf (1925) at three, six and nine months, Grover (1915) at three, six and twelve months, Crum (1916) at six, nine and twelve months, Boyd (1941) at six and twelve months, and Wallis (1931) at twelve months.

c. At eighteen and twenty-four months: For males only, Rhoads, Rapoport, Kennedy and Stokes (1941); for males and females, Bayley and Davis (1935), Benedict and Talbot (1921), Boyd (1941), Crum (1916), Grover (1915), Iowa Child Welfare Research Station (1931), Maresh and Washburn (1938), Meredith (1940), Mohr and Bartelme—full-term—(1934), Peatman and Higgons (1938), Rude (1922), Simmons and Todd (1938), Stuart (1934), and Woodbury—total White cases—(1921). At eighteen months only: For both sexes, Baldwin, Fillmore and Hadley (1930), Bowditch (1872), Gebhart (1924) and Peckham (1882). At twenty-four months: For females only, Swanson (1926) and Wise (1941); for both sexes, Blatt (1921), Freeman (1933), Johnson (1925), Wallis (1931) and Wilson, Sweeny, Stutsman, Chesire and Hatt (1930).

AVERAGE STATURE (cm.) OF WHITE INFANTS STUDIED IN NORTH AMERICA 1850-1941

Age	Males .		Females		Excess of Males
(mos.)	Cases	Mean	Cases	Mean	Over Females
Birth	4548	50.7	4412	50.0	0.7
3	4718	61.0	4270	59.7	1.3
6	5093	67.1	4507	65.5	1.6
9	4794	70.9	4483	69.4	1.5
12	4644	74.4	4109	72.8	1.6
18	3564	80.3	3293	79.0	1.3
24	3748	85.4	3412	83.9	1.5

A further series of pooled averages was secured for male and female White infants drawn from the middle and upper socioeconomic groups during the years 1926-41. In this series the list of infancy ages was extended to nine. The method of pooling was the same as for the preceding tabulation. The sources of the data utilized in deriving each composite figure are indicated below.

a. At birth: For males only, Bakwin and Bakwin—"moderate income" families—(1934); for both sexes, Gunstad and Treloar—private cases—(1936), Simmons and Todd (1938) and Stuart (1934).

b. At one month: For males and females, Bayley and Davis (1935), Maresh and Washburn (1938), and Peatman and Higgons (1938).

c. At three, six, nine and twelve months: For both sexes, Bakwin, Bakwin and Milgram—"moderate-income" families—(1934), Bayley and Davis (1935), Gesell and Thompson (1938), Maresh and Washburn (1938), Meredith (1940), Peatman and Higgons (1938), Simmons and Todd (1938) and Stuart (1934). At twelve months only: Sawtell (1929).

d. At fifteen, eighteen and twenty-four months: For each sex, Bayley and Davis (1935), Maresh and Washburn (1938), Meredith (1940), and Peatman and Higgons (1938). At eighteen and twenty-four months: Simmons and Todd (1938) and Stuart (1934). At twenty-four months only: Sawtell (1929).

AVERAGE STATURE (cm.) OF WHITE INFANTS FROM MIDDLE AND UPPER CLASSES MEASURED 1926-41

Age	Males		Females		Excess of Males
(mos.)	Cases	Mean	Cases	Mean	Over Females
Birth*	772	50.8	568	50.0	0.8
1	202	54.8	177	53.8	1.0
3	631	61.2	559	59.7	1.5
6	620	67.9	579	66.0	1.9
9	567	72.5	541	70.7	1.8
12	573	76.4	587	74.4	2.0
15	304	79.7	246	78.0	1.7
18	451	82.5	450	81.0	1.5
24	454	88.1	431	86.5	1.6

*The means at birth would have been the same had the data combined been for White infants of all socio-economic levels studied over the years 1910-41. It will be recalled that previous syntheses, treating both sexes jointly, gave the same mean (50.4 cm.) for White infants measured 1910-25, White infants measured 1926-41, White infants of the lower classes, and White infants of the middle and upper classes.

It is unnecessary to itemize the findings from both the above tabulations. From the latter—that reducing data collected between 1926 and 1941 on North American White infants representing a moderately high socio-economic level—it is found:

1. Male infants exceed female infants in average stature at all ages from birth to two years.
2. At birth, the magnitude of the difference between the male and female means is 0.8 cm., or practically one-third of an inch.
3. Over the age period from three months to two years, the trend of central tendency for females is lower than that for males by approximately 1.7 cm., or two-thirds of an inch.

Absolute stature, variability

Tables Ic, II, IIIc, IVc, Vc, VIc, VII, VIIIc, and IXc of the appendix afford a total of 230 standard deviations, a like number of coefficients of variation, and 554 other values relating to variability. These tables should be examined carefully and each row of figures appraised with reference to the particular body of data being described. In this, it is assumed the reader is cognizant of the influence on variability of such variables as size of sample, selection of sample, reliability of data, and age grouping of data.

In an attempt to approximate a synthesis of the information assembled on variability of stature, six statistical constants were selected and the values for each distributed and abridged. For example, the fifteen standard deviations on one-year-old male infants shown in Table VIc were first arranged in rank order and then epitomized by taking a) the median of the series and b) the two extreme values. The same procedure was followed in reduction of the coefficients of variation, the twenty-fifth and seventy-fifth percentiles, and the minimum and maximum figures. Separate analyses were made for males and females at each of seven ages. The results are given in the following tabulation.

CENTRAL TENDENCY AND EXTREME VALUES (cm.) FOR VARIABILITY OF STATURE

Age	Standard Deviation		Coefficient of Variation		Minimum Value	
	Median	Range	Median	Range	Median	Range
Birth:						
Males	2.1	1.7- 3.0	4.1	3.3- 5.9	44.5	38.0-46.9
Females	2.1	1.5- 3.6	4.1	3.1- 7.1	45.1	35.0-45.6
3 mos.:						
Males	2.7	1.5- 4.6	4.4	2.5- 7.4	55.5	46.0-58.3
Females	2.6	2.0- 3.4	4.3	3.4- 5.7	52.5	46.0-55.2
6 mos.:						
Males	2.3	1.1- 3.8	3.5	1.6- 5.7	62.5	53.0-64.9
Females	2.3	2.0- 3.9	3.6	3.0- 6.0	58.9	53.0-62.3
9 mos.:						
Males	2.5	1.8- 4.1	3.5	2.5- 5.7	66.8	58.0-69.0
Females	2.6	1.9- 5.1	3.7	2.7- 7.4	63.8	56.0-67.7
12 mos.:						
Males	2.6	2.0- 4.8	3.4	2.6- 6.4	70.0	53.0-72.8
Females	2.6	1.8- 5.3	3.5	2.4- 7.0	68.2	56.0-71.1
18 mos.:						
Males	3.0	2.3- 5.1	3.6	2.8- 6.4	76.1	61.0-78.9
Females	3.1	2.4- 7.1	3.8	2.9- 9.0	74.0	61.0-76.2
24 mos.:						
Males	3.3	2.5- 4.3	3.8	2.8- 5.0	81.0	69.0-85-1
Females	3.3	2.0- 4.4	3.7	2.4- 5.3	80.0	69.0-84.6

	Twenty-fifth Percentile		Seventy-fifth Percentile		Maximum Value	
	Median	Range	Median	Range	Median	Range
Birth:						
Males	49.2	48.7-49.6	52.2	51.5-52.5	56.0	54.4- 62.0
Females	48.7	48.1-48.8	51.0	50.2-51.8	56.1	51.9- 59.0
3 mos.:						
Males	59.2	58.9-59.8	62.9	62.2-63.9	66.5	64.6- 76.0
Females	57.9	57.6-58.5	61.3	60.3-62.0	65.0	62.8- 74.0
6 mos.:						
Males	65.4	64.8-66.7	69.1	68.3-70.3	73.9	70.5- 84.0
Females	64.1	62.9-64.9	67.5	66.8-67.8	71.8	69.2- 84.0
9 mos.:						
Males	69.7	68.2-71.4	72.9	72.3-74.6	78.3	75.0- 89.0
Females	68.4	66.8-69.2	71.8	71.2-72.8	76.5	73.9- 89.0
12 mos.:						
Males	73.7	71.5-75.2	77.6	76.3-78.7	81.1	79.5- 94.0
Females	72.3	70.1-73.1	75.8	74.6-77.0	80.2	77.0- 91.0
18 mos.:						
Males	80.5	77.5-81.4	83.9	82.4-85.6	89.0	82.0- 99.0
Females	79.5	76.0-80.0	83.1	81.0-83.6	86.7	79.0- 94.0
24 mos.:						
Males	86.2	82.2-86.8	89.7	87.4-90.7	95.7	91.4-107.0
Females	84.6	80.8-85.7	88.3	85.9-89.3	92.3	90.4-104.0

Giving joint consideration to the typical (median) values from this tabulation and to other relevant materials, there accrue the findings listed below.

1. Over the age period from birth to two years, the absolute variability of stature for male infants is neither consistently nor appreciably different from that for female infants. The typical figure for each sex is 2.1 cm. at birth, 2.3 cm. at six months, 2.6 cm. at one year, and 3.3 cm. at two years.

In view of findings obtained by Meredith and Goodman (1941), it appears probable that the typical figure of 2.1 cm. at birth is spuriously high. These authors compared "routine hospital records of birth stature with measurements of birth stature obtained for longitudinal research." For 100 infants, 50 of each sex, the standard deviation from the hospital records was 2.4 cm. From the data collected on the *same* 100 infants through the use of a highly reliable anthropometric technique, the standard deviation was 1.6 cm.

2. The median coefficient of variation at birth is 4.1 per cent for each sex. The coefficient from the research data gathered by

Meredith and Goodman—both sexes together—was 3.2 per cent.

During the age period from six months to two years, the median coefficient of variation fluctuates between 3.4 per cent and 3.8 per cent. The intermediate value of 3.6 per cent may be taken as representative (within the age limits of six months and two years) of the relative variability of both males and females.

3. At all ages from birth to two years the typical value for the twenty-fifth percentile is lower on females than on males. The same relationship holds for the seventy-fifth percentile.

These findings are consistent with the findings on sex differences in average stature and also with findings reported by Christie, Dunham, Jenss and Dippel (1941). Utilizing stature records for 297 newborn White males, Christie, Dunham, Jenss and Dippel found 12.5 per cent to lie below 47.0 cm., and 50.5 per cent to fall at or above 50.0 cm. Corresponding percentages from 266 newborn White females were 16.5 per cent and 33.8 per cent.

4. On both male and female infants, the interquartile range (seventy-fifth percentile minus twenty-fifth percentile) fluctuates around 3.6 cm. at ages twelve, eighteen and twenty-four months. For ages three, six and nine months, it approximates 3.5 cm. on males and 3.4 cm. on females.

At birth, the interquartile range from the research data amassed by Meredith and Goodman was 1.9 cm. Estimates of the interquartile range at birth derived from the medians of the twenty-fifth and seventy-fifth percentiles are higher by 1.1 cm. for males and 0.4 cm. for females.

Generalizing, it appears that the zone which encompasses the central one-half of the stature distribution for each sex approximates four-fifths of an inch at birth and widens to one and one-half inches by two years of age.

5. The typical range at birth (median of maximal values minus median of minimal values) is 11.5 cm. for male infants and 11.0 cm. for female infants. The range from Meredith and Goodman—both sexes combined—was 8.8 cm.

At ages three, six, nine and twelve months, the typical range for each sex lies in the vicinity of 12.0 cm. At eighteen and twenty-four months the ranges cluster about 13.0 cm.

A working approximation of the full range of the stature distribution for normal White infants of each sex may be taken as four inches at birth and as broadening to five and one-half inches at two years of age.

For infants of middle and upper socio-economic status studied in the period 1926-41, composite measures of variability were obtained at six ages. Specifically, composite standard deviations[7] and coefficients of variation were secured at quarterly ages from three months to one year and at semiannual ages from one to two years on male infants, female infants, and infants of both sexes. The investigations utilized were those of Bakwin, Bakwin and Milgram—"moderate income" families—(1934), Bayley and Davis (1935), Gesell and Thompson (1938), Meredith (1940), Peatman and Higgons (1938), Simmons and Todd (1938) and Stuart (1934).

VARIABILITY OF STATURE FOR WHITE INFANTS OF THE MIDDLE AND UPPER CLASSES STUDIED 1926-41

Age	Standard Deviation			Coefficient of Variation		
(mos.)	Males	Females (cm.)	Both Sexes	Males	Females (per cent)	Both Sexes
3	2.5	2.3	2.5	4.1	3.9	4.1
6	2.4	2.3	2.6	3.5	3.5	3.9
9	2.5	2.5	2.7	3.4	3.5	3.8
12	2.7	2.8	2.9	3.5	3.8	3.8
18	3.0	3.0	3.1	3.7	3.7	3.8
24	3.3	3.3	3.4	3.7	3.8	3.9

Selected findings are as follows:

1. The absolute and relative variabilities on male infants are practically identical with those on female infants. For each sex, the composite standard deviation is 2.5 cm. at nine months, 3.0 cm. at eighteen months, and 3.3 cm. at two years. The average of the series of variation coefficients for females is 3.7 per cent, with that for males reaching almost the same figure.

2. Compared with the composite standard deviations for each sex separately, the standard deviations on both sexes tend to be higher by 0.1 cm. to 0.2 cm. Correspondingly, the average of the

---

[7] In algebraic notation, the formula employed in calculation of each of these values was

$$S.D._c = \sqrt{\frac{N_1(S.D._1^2 + d_1^2) + N_2(S.D._2^2 + d_2^2) + \ldots + N_r(S.D._r^2 + d_r^2)}{N_1 + N_2 + \ldots + N_r}}$$

in which $S.D.$ symbolizes standard deviation, N symbolizes number of measures, d represents the deviation of the mean of a component sample from the mean for the composite sample, subscript c designates the composite sample, and the numerical subscripts designate component samples.

coefficients of variation for the two sexes jointly is raised to 3.9 per cent.

3. The composite standard deviations for both sexes taken together show a gradual increase in magnitude from 2.5 cm. (one inch) at age three months to 3.4 cm. (one and one-third inches) at age two years.

For additional measures of variability on infants of the middle and upper socio-economic levels measured in the period 1926-41, the reader is referred to the studies by Bayley and Davis (1935), Meredith (1940), and Stuart (1934). In each instance, particular attention was given to the reliability of the original data, the sample was well delineated, and the data were collected to fall within narrow age groups.

Rate of growth, stature increments

In synthesizing sex differences in the absolute magnitude of stature, male and female averages were presented for "White Infants Studied in North America 1850-1941" (see p. 43) and for "White Infants from the Middle and Upper Classes Measured 1926-41," (see p. 44). These averages were used to derive the tabulation of gains given on p. 50. To illustrate, the centimeter increment for the first quarter-year on 1850-1941 White males was obtained by subtracting their average stature at birth from their average stature at age three months. The percentage increment was computed at this difference (10.3 cm.) divided by average stature at the beginning of the quarter (50.7 cm.).

Centimeter and percentage increments are afforded for selected quarterly, semiannual, and annual periods. Each value should be interpreted as representing the increase in central tendency at the terminal age of a period on central tendency status at the initial age.

The tabulation (p. 50) yields the following findings:

1. There is a continuous decline in the rate of stature growth from birth to two years of age. For example, increase in average stature is greater between birth and three months than between three and six months. With each successive quarter-year the amount of gain diminishes.

2. The decline in growth rate is rapid in early infancy and becomes gradually slower with advancing age. This is illustrated

ABSOLUTE AND RELATIVE GAINS DERIVED FROM COMPOSITE AVERAGES FOR STATURE

Age Interval (mos.)	Centimeter Increment		Percentage Increment	
	Males	Females	Males	Females
White Infants Studied in North America 1850-1941				
Quarter-year:				
Birth to 3	10.3	9.7	20.3	19.4
3 to 6	6.1	5.8	10.0	9.7
6 to 9	3.8	3.9	5.7	6.0
9 to 12	3.5	3.4	4.9	4.9
Half-year:				
Birth to 6	16.4	15.5	32.3	31.0
6 to 12	7.3	7.3	10.9	11.1
12 to 18	5.9	6.2	7.9	8.5
18 to 24	5.1	4.9	6.4	6.2
Full year:				
Birth to 12	23.7	22.8	46.7	45.6
12 to 24	11.0	11.1	14.8	15.2
White Infants from Middle and Upper Classes Measured 1926-41				
Quarter-year:				
Birth to 3	10.4	9.7	20.5	19.4
3 to 6	6.7	6.3	10.9	10.6
6 to 9	4.6	4.7	6.8	7.1
9 to 12	3.9	3.7	5.4	5.2
Half-year:				
Birth to 6	17.1	16.0	33.7	32.0
6 to 12	8.5	8.4	12.5	12.7
12 to 18	6.1	6.6	8.0	8.9
18 to 24	5.6	5.5	6.8	6.8
Full year:				
Birth to 12	25.6	24.4	50.4	48.8
12 to 24	11.7	12.1	15.3	16.3

in that average stature at six months is over 30 per cent greater than average stature at birth, while average stature at one year is only about 12 per cent greater than at six months, and average stature at two years is less than 7 per cent greater than at eighteen months.

3. Over the full age span from birth to two years, the increase in average stature for North American White infants studied 1850-1941 is 34.7 cm. (68.4 per cent) on males and 33.9 cm. (67.8 per cent) on females. Corresponding figures from the data on White infants of the middle and upper classes accumulated 1926-41 are 37.3 cm. (73.4 per cent) and 36.5 cm. (73.0 per cent) for males and females respectively.

4. During the first six months following birth the average male infant gains in stature more rapidly than the average female infant. From the composite of White infants for 1850-1941 the gains are 16.4 cm. (32.3 per cent) on the former, and 15.5 cm. (31.0 per cent) on the latter. From the 1926-41 subanalyses, the centimeter gains on male and female infants are 17.1 and 16.0, while the percentage increments are 33.7 and 32.0. In general, then, the advances in average stature may be estimated as one centimeter and 1.5 per cent less for females than for males.

5. Between ages six months and two years the increase in average stature for female infants is no less than that for male infants. The centimeter increments are 18.4 (females) and 18.3 (males) from the 1850-1941 pooling, 20.5 (females) and 20.2 (males) from the 1926-41 pooling. In percentage terms the gains for females exceed those for males by roughly 1 per cent.

Stature increments for the period from birth to one month were analysed by Freeman and Platt (1932). Their subjects were 31 males and 40 females, some White and some Negro. The centimeter increments gave means of 4.0 in the case of males and 3.5 for females. Values from the conversion of centimeter increments into percentage increases yielded means of 8.2 and 7.1 respectively. For the 1926-41 composite of White infants from the middle and upper socio-economic levels, average stature at one month exceeds that at birth by 4.0 cm. and 7.9 per cent for males, by 3.8 and 7.6 per cent for females.

Annual and semiannual gains based on highly reliable measurements of stature taken on the first day of postnatal life, at six months of age, and at the end of the first year are available from Meredith (1941). The subjects were 18 Iowa City residents of northwest European descent. Ten (four males and six females) were drawn from the professional or managerial groups, the remainder (six males and two females) from the unskilled or semiskilled groups.

CENTRAL TENDENCY AND VARIABILITY OF GAIN IN STATURE (cm.) DURING FIRST YEAR

Sex	Cases	Birth to 6 mos.		6 mos. to 12 mos.		Birth to 12 mos.	
		Mean	Range	Mean	Range	Mean	Range
Males	10	17.6	15.6-19.9	8.2	7.2-9.9	25.8	23.1-28.3
Females	8	16.1	14.0-17.5	8.1	7.2-9.0	24.2	22.0-26.3

As was found from the composite averages for 1850-1941 and for

1926-41, during the age interval from birth to six months the mean gain in stature of male infants is *greater* than that of female infants. For the succeeding half-year there is likewise agreement regarding the *similarity* of the two sexes in average gain. Over the age span from birth to one year, the mean gains of 25.8 cm. and 24.2 cm. closely approximate the gains derived using the composite stature averages on White infants of the middle and upper classes measured 1926-41 (25.6 cm. for males and 24.4 cm. for females).

Eliot, Nelson, Barnes, Browne and Jenss (1936) reported average monthly increment values representing the postnatal age span from five to twenty-eight weeks. The subjects were 567 Detroit infants, 232 Negro and 335 White, of the indigent and near-indigent classes. They resided "in their own homes," but were regularly supervised and supplied an antirachitic substance by the Children's Fund of Michigan. For each infant, stature was determined at approximately monthly intervals and the whole series of measurements graduated by a straight line equation. This equation was then used to calculate the "average monthly increase in length" over the period the child was under study. Means from these values were 2.5 cm. for White males, 2.3 cm. for White females, 2.5 cm. for Negro males and 2.4 cm. for Negro females. The 1926-41 composite averages for White infants representing a moderately high socio-economic level yield mean monthly gains for the period from one to six months of 2.6 cm. on males and 2.4 cm. on females.

Increment analyses covering the age interval from three months to one year are available on White infants from Maresh and Washburn (1938), Meredith (1941) and Simmons and Todd (1938). The results are displayed at the top of the following page (53). Combining these studies, mean gains are obtained of 15.2 cm. for males (198 cases) and 14.9 cm. for females (164 cases). The increases in the 1926-41 stature averages for White infants of similar socio-economic levels are 15.2 cm. and 14.7 cm. for males and females, respectively. The minimum gain for males from Maresh and Washburn is 11.8 cm., from Meredith 12.4 cm. On females, the minima are 10.3 cm. and 11.6 cm. respectively. Corresponding maxima are 18.2 cm. and 19.0 cm. on males, 18.0 cm. and 18.3 cm. on females. With infants of both sexes, working limits of the normal zone of individual differences in stature gain over the

STATURE GAIN (cm.) OF MALE AND FEMALE INFANTS FROM THREE MONTHS TO ONE YEAR

	Number	Mean	Standard Deviation	Percentiles		Range
				25th	75th	
Maresh and Washburn (1938):						
Males	15	15.1				11.8-18.2
Females	12	14.7				10.3-18.0
Meredith (1941):						
Males	82	15.4		14.1	16.7	12.4-19.0
Females	65	14.9		13.9	16.0	11.6-18.3
Simmons and Todd (1938):						
Males	101	15.0	1.82			
Females	87	15.0	1.89			

period from three months to one year may be estimated at 11.0 cm. and 19.0 cm.

For increase in stature between the ages of one and two years, three series of data are accessible for synthesis. The investigators are the same as for the period from three months to one year.

GAIN IN STATURE (cm.) OF MALES AND FEMALES BETWEEN AGES ONE AND TWO YEARS

	Number	Mean	Standard Deviation	Percentiles		Range
				25th	75th	
Maresh and Washburn (1938):						
Males	14	12.2				10.3-15.2
Females	15	12.4				8.5-16.2
Meredith (1941):						
Males	108	11.7		10.8	12.7	8.8-15.1
Females	104	12.4		11.5	13.6	9.0-16.1
Simmons and Todd (1938):						
Males	49	12.4	1.25			
Females	44	13.2	1.81			

There is a consistent tendency for the mean gains of females to exceed those of males. From the three studies combined, the mean gain is 11.9 cm. for males (171 cases) and 12.6 cm. for females (163 cases). As was shown earlier, the composite stature averages for White infants of the middle and upper classes studied in the period 1926-41 were higher at two years than at one year by 11.7 cm. and 12.1 cm. for males and females, respectively. The interquartile range for gain in stature between one and two years (as derived from the percentile values reproduced above from Meredith) approximates two centimeters on each sex. Individual differences in gain may be coarsely characterized as varying from 8.5 cm. for each sex to around 15.5 cm. for males and 16.5 for females.

Over the full age span from birth to two years, increment means are obtainable on eight White males and eleven White females. The male series includes one infant of the professional classes from King (1910), two infants of the managerial classes and three of the unskilled and semiskilled classes from Meredith (1941), and two infants of the middle and upper middle classes—cousins—from Stuart (1939). Included in the female series are two infants of the upper classes from Gray and Faber (1940), five infants of the professional and managerial classes and one of the semiskilled classes from Meredith, one infant of the upper classes from Shinn (1893), and two infants of the middle and upper middle classes—cousins—from Stuart. The means are 38.5 cm. and 36.1 cm. for males and females, respectively. Compared with differences between the composite averages at birth and two years, the male mean is considerably higher than either that for White infants studied 1850-1941 (34.7 cm.) or that for White infants of the middle and upper classes studied 1926-41 (37.3 cm.). Incidentally, the mean increment for the three male subjects of the unskilled and semiskilled classes—all having decidedly poor health histories—is identical with the difference between the 1926-41 composite means for infants of the middle and upper classes. The female mean of 36.1 cm. exceeds the figure of 33.9 cm. from the composite averages for 1850-1941, but is not higher than the difference of 36.5 cm. between the composite values for 1926-41.

DIFFERENCES AMONG SERIATIM RECORDS FOR INDIVIDUAL INFANTS

Leading questions: To what extent does the individual infant hold the same position in the distributions of stature for successive ages? Do short neonates usually become short infants at one year of age? Are infants who are tall at two years of age frequenty below average in stature at birth?

Do all nonpathologic infants gain in stature at a faster rate during the first half-year of postnatal life than during the second half-year? To what extent does stature increase at a continuously slower pace for some infants and faster pace for others? Alternatively, among normal infants, are there those who gain at a higher rate than average over some age intervals and a lower rate than average over other age intervals, and vice versa?

What is the relation between absolute stature and rate of growth in stature? Do infants tall at birth gain in stature at a faster or slower rate during their first postnatal year than those short at birth? Is the rate of stature growth during the second year different for infants who are short at one year of age than for those who are tall at this age?

The three areas in which these questions lie will be considered serially under the captions: Absolute stature, rate of growth in stature, and association between absolute stature and rate of gain in stature.

Absolute stature

On each of 28 nonpathologic male infants, protocols for stature are available extending over periods of not less than eleven months. In eight instances the age period covered is from birth to two years, and in an additional eleven it is from one month after birth to two years.

TABLE Xa

SERIATIM RECORDS FOR STATURE (cm.) ON TWENTY-EIGHT WHITE MALE INFANTS

	Age in months:						Other data
	Birth	1	6	12	18	24	
Hall (1896):		51.5	67.1	74.5	83.0		Professional class, measured recumbent.
King (1910):							Brothers; born 1903, 1906; professional classes.
A	52.1	56.6	70.1	80.3	88.0	90.7	
B		57.2	69.9	78.2	85.9	88.6	
Davenport (1938):							Born 1933, 1935; received the vitamin needs for growth.
A		57.6	71.9	80.7			
B		55.2	68.3	79.2			
Maresh and Washburn (1938):							
1		52.5	69.3	76.5	82.0	88.0	Born 1932-5; infants

TABLE Xa—(Continued)

		Age in months:					
	Birth	1	6	12	18	24	Other data
3		54.5	67.3	73.8	81.5	89.0	"average healthy"; mainly of minor managerial and skilled trade groups, some in professional and managerial classes.
8		53.5	66.5	74.0	80.0	86.0	
9		50.0	63.5	72.0	79.5	85.0	
13		52.5	68.0	76.5	82.5	88.0	
19		55.3	69.0	77.0	84.0	90.0	
23		52.0	64.0	73.5	80.5	86.0	
26		51.5	67.0	76.3	81.8	86.5	
28		51.0	65.5	72.5	77.5	84.5	
35		51.5	65.0	75.3	80.0	86.8	
Stuart (1939):							
A-1	47.0		62.3	72.8	80.8	83.7	First cousins; born 1931, 1934; middle and upper middle classes; measured recumbent.
B-1	51.7		67.8	77.3	84.3	90.5	
Gray (1941):				76.0		91.0	Infant "normal".
Meredith (1941):							
C	51.0		69.7	79.3	85.5	91.0	Born 1940; subjects C to Sc of professional and managerial classes, subjects Rg to L of unskilled and semiskilled classes; all measured recumbent.
Li	52.4		72.3	80.4	87.6	94.7	
K	49.8		67.5	77.4			
Sc	50.2		66.1	73.3			
Rg	50.0		68.5	75.8	82.7	86.8	
Mo	50.5		66.8	74.6	81.7	87.3	
M	51.4		67.0	75.9	84.1	89.6	
S	49.5		68.1	76.5	83.0		
Re	50.0		68.2	75.5	81.8		
L	51.1		67.6	75.4			

Findings which accrue from intercomparison of these records are:

1. In relation to infant 8 from Maresh and Washburn (1938), the infant studied by Hall (1896) is 2.0 cm. shorter at one month and 3.0 cm. taller at eighteen months.

2. For the King (1910) brothers, A is shorter than B by 0.6 cm. at one month and taller than B by 2.1 cm. at eighteen and twenty-four months.

3. Aligned with subject B from King, Davenport's (1938) subject B is 2.0 cm. shorter at one month and 1.0 cm. taller at one year. Compared with subject 19 from Maresh and Washburn, Davenport's subject B is similar in stature at one month and 2.2 cm. taller at one year.

4. Infants 1 and 13 from Maresh and Washburn have identical stature values at ages one month, one year, and two years. With reference to Maresh and Washburn's infant 8, infants 1 and 13 are each shorter by 1.0 cm. at one month, taller by 2.5 cm. at one year, and taller by 2.0 cm. at two years.

5. Juxtaposition of Stuart's (1939) subject B-1 and King's subject A shows the former to be negligibly shorter (0.4 cm.) than the latter at birth, shorter by 3.0 cm. at one year, and negligibly shorter (0.2 cm.) at two years. Stuart's subject A-1 has the smallest measurement shown at birth (2.5 cm. lower than the next larger record), is slightly taller than two other infants at one year, and yields a record at two years 1.2 cm. smaller than that of any of the others.

6. Compared with King's infant A, Gray's (1941) infant is shorter by 4.3 cm. at one year, although fully as tall at two years. In relation to infant 26 from Maresh and Washburn, Gray's infant is negligibly shorter (0.3 cm.) at one year, yet 4.5 cm. taller at two years.

7. Subjects K and Sc from Meredith (1941) approximate the same stature at birth (Sc is the taller by 0.4 cm.), although Sc is 4.1 cm. shorter than K at one year. Also from Meredith, subject M is taller than Rg by 1.4 cm. at birth, equally as tall at one year, and 2.8 cm. taller at two years.

Similar protocols to the above are available for 24 nonpathologic female infants. Eleven of these cover the full period from birth to two years of age, while another eight extend from one month to two years.

TABLE Xb

SERIATIM RECORDS FOR STATURE (cm.) ON TWENTY-FOUR WHITE FEMALE INFANTS

	Age in months:						Other data
	Birth	1	6	12	18	24	
Shinn (1893):	48.3		63.5	72.2	78.7	83.8	Resided "on a fruit ranch," measured erect at 18 and 24 months.
McLeish (1898):		62.2	74.3	81.3			Resided in the country, measured recumbent.

TABLE Xb—(Continued)

		Age in months:					
	Birth	1	6	12	18	24	Other data
Davenport and Drager (1936):		54.4	65.1	73.0	79.2	84.0	Born 1933; received the vitamin needs for growth.
Davenport (1938):		50.7	62.2	71.0			Born 1933; received the vitamin needs for growth.
Maresh and Washburn (1938):							
39		52.8	61.5	72.0	78.5	83.5	Born 1932-35; "average healthy" infants; mainly of minor managerial and skilled trade groups, some in professional and managerial classes.
45		49.5	61.0	69.5	75.0	81.5	
48		51.5	63.0	71.5	80.0	85.5	
50		52.0	64.0	75.5	82.5	89.5	
52		58.0	70.5	78.0	84.5	91.3	
55		52.3	64.0	71.0	75.5	81.5	
62		53.0	66.5	75.5	84.5	91.8	
Stuart (1939):							
A-3	49.7		64.6	72.7	78.5	84.0	A-3 and A-2 sisters; B-2 first cousin of A-2 and A-3; middle and upper middle classes; measured recumbent.
B-2	53.7		68.0	76.6	84.7	89.6	
A-2			63.3	71.2	77.5	83.2	
Gray and Faber (1940):							
B	47.0		68.2	74.9		85.1	Both infants born 1921; economic status "ideal."
A	53.0					88.0	
Meredith (1941):							Born 1940; subjects W to Mc of professional and managerial classes, subjects A and Ri of unskilled and semiskilled classes; all measured in dorsal recumbency.
W	50.2		67.5	76.5	84.6	90.7	
R	50.3		67.1	75.9	83.3	90.4	
Co	50.4		65.2	72.6	80.0	84.8	
Ko	51.4		68.2	76.1	82.3	85.4	
O	52.0		67.9	76.0	83.4	88.3	
Mc	49.6		67.1	74.3			
A	49.7		63.7	71.7	78.0	82.7	
Ri	48.2		63.8	72.4	79.7		

Comparisons among the records of this table yield the following items:

1. In relation to subject B from Gray and Faber (1940), the subject studied by Shinn (1893) is taller by 1.3 cm. at birth and shorter by 2.7 cm. and 1.3 cm. at ages one and two years respectively. Aligned with subject A from Meredith (1941), Shinn's subject is shorter by 1.4 cm. at birth and taller by 0.5 cm. at one year and by 1.1 cm. at two years.

2. The infant measured by McLeish (1898) gives the largest values of the series. The nearest in order of magnitude are the values for Maresh and Washburn's (1938) infant 52, which are lower by 4.2 cm. at one month and by 3.3 cm. at one year. Referred to Table Xa for males, the McLeish infant exceeds the largest male record—that for infant A from Davenport (1938)—by 4.6 cm. at one month and 0.6 cm. at one year.

3. Compared with subject 50 from Maresh and Washburn, Davenport and Drager's (1936) subject is 2.4 cm. taller at one month, 1.1 cm. taller at six months, 2.5 cm. shorter at one year, and 5.5 cm. shorter at two years. In relation to Maresh and Washburn's subject 62, the Davenport and Drager subject is taller by 1.4 cm. at one month and shorter by 1.4 cm., 2.5 cm. and 7.8 cm. at six months, one year, and two years, respectively.

4. Infants 45 and 55 from Maresh and Washburn converge in stature from a difference of 2.8 cm. at one month, through a difference of 1.5 cm. at one year, to identical statures at two years. A similar, though more marked, convergence is registered for infants 52 and 62. Infants 39 and 62 diverge from practically equal statures at one month to statures which differ by 8.3 cm. at two years. Divergence of like magnitude occurs for infants 50 and 55.

5. Juxtaposition of subjects A-3 from Stuart (1939) and B from Gray and Faber shows the former to be the taller at birth by 2.7 cm. and the latter to be the taller at two years by 1.1 cm. Stuart's subject B-2, in comparison with Meredith's subject W, is taller at birth by 3.5 cm. and shorter at two years by 1.1 cm.

6. Gray and Faber's two infants converge in stature, reducing their difference from 6.0 cm. at birth to 2.9 cm. at two years. Aligned with infant Ko from Meredith, the Gray and Faber infant B is 4.4 cm. shorter at birth and practically the same stature (0.3 cm. shorter) at two years.

7. Subjects W, R, and Co from Meredith are negligibly differ-

ent in stature at birth. At age two years W and R have statures almost identical, while Co is shorter than W by 5.9 cm. and shorter than R by 5.6 cm.

Age to age changes in stature rank have been investigated not only by the foregoing method of intercomparison among individuals, but also by comparison of individuals with the group (*e.g.*, obtaining the percentile positions of particular infants in the stature distributions for various ages), comparison of a subgroup with the group (*e.g.*, taking those infants in the upper quarter for stature at a selected age and determining their locations in the stature distribution at another age), and simultaneous intercomparison of all the individuals in a group for whom there are measurements of stature at two or more constant ages (*e.g.*, computing a coefficient of correlation between stature at one age and stature at a different age).

At several ages between birth and two years, Stuart (1939) referred four infants (two males and two females) to distributions for stature obtained from repeated measurement of upwards of 100 infants examined at the Center for Research in Child Health and Development, Harvard School of Public Health. Each of the four infants manifested changes in stature rank of more than twenty percentile points. One of the males (A-1) placed at the first percentile at six months and at the twenty-third at eighteen months; the other male (B-1, a first cousin of A-1) ranked at the sixty-fourth percentile at nine months and at the eighty-sixth at two years. For the females, the sister of A-1 placed at the forty-second percentile at three months and at the twenty-first at eighteen months, while the sister of B-1 ranked at the ninty-ninth percentile at birth and at the seventy-sixth at one year. An additional female infant (another sister of A-1 and cousin of B-1) was followed from three months to two years and found to manifest an almost constant position in the successive stature distributions. In quantitative terms, this infant fluctuated between the fifteenth and twenty-first percentiles.

For 38 of the 52 individuals included in Table Xa and Xb, stature values were reported at ages six months and two years. These values could be used to derive changes in percentile position between the two ages by referring them to the Meredith (1940) distributions for stature on infants of the professional and managerial classes studied 1930-39. Summarizing the results for both sexes jointly, 50 per cent showed differences in percentile rank of less than ten points, 24 per cent of ten to nineteen points, 10 per cent of twenty to twenty-nine points, and 16 per cent of thirty to sixty points.

Utilizing records on 99 males and 92 females each measured at ages three months and two years, Simmons and Todd (1938) employed the procedure of identifying those infants who composed the upper and lower quarter segments of the stature distributions at three months with reference to their disposition in the stature distributions at two years. For the male upper quarter at three months (25 infants), 52 per cent were in the upper quarter at two years, 40 per cent were scattered throughout the central one-half of the distribution, and the remaining 8 per cent were in the lower quarter. Parallel percentages from the 25 males constituting the lower quarter at three months were 52, 32, and 16, respectively. The female subgroups consisted of 23 infants each and gave percentages at two years of 65, 35, and 0 for the shortest fourth of the group at three months and, for the tallest fourth, of 57, 34, and 9.

Several investigators have used the correlation method of studying the extent to which infants maintain their stature ranks from age to age. At selected paired ages, the coefficients (Pearson product-moment) obtained are reproduced below.

COEFFICIENTS INDICATING RELATIONSHIPS BETWEEN STATURE AT DIFFERENT INFANCY AGES

	Birth with 12 mos.		1 mo. with 12 mos.		3 mos. with 12 mos.	
	Cases	*r*	Cases	*r*	Cases	*r*
Maresh and Washburn (1938):						
Both sexes			46	.54		
Males			25	.42		
Females			21	.65		
Simmons and Todd (1938):						
Males	62	.40			104	.66
Females	41	.30			99	.72
Meredith (1940):						
Both sexes					69	.74
Meredith (1941):						
Both sexes	18	.58				

	1 mo. with 24 mos.		3 mos. with 24 mos.		12 mos. with 24 mos.	
	Cases	r	Cases	r	Cases	r
Bayley and Davis (1935):						
Both sexes	43	.68	43	.71	43	.93
Males					24	.94
Females					19	.88
Maresh and Washburn (1938):						
Both sexes	39	.50				
Males	21	.51				
Females	18	.47				
Simmons and Todd (1938):						
Males			101	.61	49	.88
Females			98	.72	44	.83
Meredith (1940):						
Both sexes			36	.51		

Findings which accrue are:

1. The association between stature at birth and stature at age one year is positive but not high. The three accessible coefficients, based on samples of 18 to 62 infants, lie between $r=.30$ and $r=.58$.
2. The degree of positive relationship between stature at one year and stature at two years is of the order $r=.85$ to .90.
3. The correlation between stature at birth and stature at two years has not been reported. As obtained on the 19 infants for whom measurements at these ages are available in Tables Xa and Xb, $r=.65 \pm .09$. This coefficient is obviously no more than a coarse estimate pending more adequate analyses. The coefficients from correlation of stature at one month and stature at two years will be seen to range from $r=.47$ to $r=.68$.

Rate of growth in stature

Individual patterns for rate of growth in stature were obtained by calculating percentage increments over selected age intervals from the 52 seriatim records assembled in Tables Xa and Xb. Seven age intervals were used—four semiannual, two annual, and one biannual. In each instance, a) absolute stature at the end of the interval was subtracted from that at the beginning, b) the difference was divided by absolute stature at the initial age, and c) the resulting product was expressed in percentage terms, *i.e.*, multiplied by 100. The percentage increments for males are presented in Table XIa.

TABLE XIa

PERCENTAGE GAINS IN STATURE FOR EACH OF TWENTY-EIGHT WHITE MALE INFANTS

	Birth to 6 mos.	6 mos. to 12 mos.	12 mos. to 18 mos.	18 mos. to 24 mos.	Birth to 12 mos.	12 mos. to 24 mos.	Birth to 24 mos.
Hall (1896)		11.0	11.4				
King (1910):							
A	34.5	14.6	9.6	3.1	54.1	13.0	74.1
B		11.9	9.8	3.1		13.3	
Davenport (1938):							
A		12.2					
B		16.0					
Maresh and Washburn (1938):							
1		10.4	7.2	7.3		15.0	
3		9.7	10.4	9.2		20.6	
8		11.3	8.1	7.5		16.2	
9		13.4	10.4	6.9		18.1	
13		12.5	7.8	6.7		15.0	
19		11.6	9.1	7.1		16.9	
23		14.8	9.5	6.8		17.0	
26		13.9	7.2	5.7		13.4	
28		10.7	6.9	9.0		16.6	
35		15.8	6.2	8.5		15.3	
Stuart (1939):							
A-1	32.5	16.9	11.0	3.6	54.9	15.0	78.1
B-1	31.1	14.0	9.1	7.4	49.5	17.1	75.0
Gray (1941)						19.7	
Meredith (1941):							
C	36.7	13.8	7.8	6.4	55.5	14.8	78.4
Li	38.0	11.2	9.0	8.1	53.4	17.8	80.7
K	35.5	14.7			55.4		
Sc	31.7	10.9			46.0		
Rg	37.0	10.7	9.1	5.0	51.6	14.5	73.6
Mo	32.3	11.7	9.5	6.9	47.7	17.0	72.9
M	30.4	13.3	10.8	6.5	47.6	18.1	74.3
S	37.6	12.3	8.5		54.5		
Re	36.4	10.7	8.3		51.0		
L	32.3	11.5			47.6		

Findings from this table are:

1. For every individual the rate of growth is markedly higher for the period from birth to six months than for the period from six to twelve months, and markedly higher for the entire first year than for the second year. Of the 22 infants for whom there are increments over the periods six to twelve months and twelve to eighteen months, the rate of growth is greater for 20 during the former period. The exceptions are the Hall (1896) subject and Maresh and Washburn's (1938) subject 3. Similarly, 16 of the 19 paired increments for the intervals twelve to eighteen months and eighteen to twenty-four months show a slower growth rate over the later interval. The exceptions here are subjects 1, 28, and 35 from Maresh and Washburn.

2. Individual differences in percentage gain range from 30.4 to 38.0 for the semiannual interval birth to six months, and for the three succeeding semiannual intervals, from 9.7 to 16.9, 6.2 to 11.4, and 3.1 to 9.2. The range of individual variation is from 46.0 per cent to 55.4 per cent for the period birth to one year, from 13.0 per cent to 19.7 per cent for the period one to two years, and from 72.9 per cent to 80.7 per cent for the period birth to two years.

3. For those infants registering increases of less than 33 per cent between birth and six months, the average gain during the following half year is 13.0 per cent; for those with increases of more than 35 per cent, the average gain is 12.2 per cent. On infants with gains below 12 per cent and above 13 per cent during the latter half of the first year, the average percentage gains during the first half of the second year are 9.0 and 9.1 respectively. Individuals gaining below 8 per cent and above 9 per cent over the first half of the second year manifest average percentage gains during the latter half of the second year of 7.3 and 6.0, respectively. In annual terms, infants yielding gains under 51 per cent and over 53 per cent for the first year give average percentage gains for the second year of 17.4 and 15.2. Obviously, there is no tendency for high rate of growth during one age interval to be associated with high rate of growth during the succeeding interval.

4. Subjects Li and S from Meredith (1941) exhibit similar percentage increments for the first postnatal year. Specifically,

the values are 53.4 and 54.5 respectively. Both subjects were artificially fed from birth. Li was drawn from the managerial socio-economic group and S from the semiskilled group. Li was entirely free from illness throughout the year, while S had diarrhea for one week in the first month, a cold in the fifth month followed by severe croup lasting for four weeks, and "flu" for three weeks (over several days the child was critically ill) in the ninth month. For the second postnatal year, the highest and lowest percentage gains from Meredith are for subjects Rg (14.5) and M (18.1). Both were of the unskilled or semiskilled classes. Rg was breastfed for one month and M artificially fed from birth. Rg had no illnesses during the year, while M developed a cold and intestinal flu in the nineteenth month and, between the twenty-first and twenty-fourth months, had bronchitis lasting three weeks followed by a cold for another two weeks.

Table XIb affords percentage increment values computed from seriatim stature records on 24 females. As previously indicated, the derivation and arrangement of this table (using the data of Table Xb) parallels that of the foregoing table for males.

TABLE XIb

PERCENTAGE GAINS IN STATURE FOR EACH OF TWENTY-FOUR WHITE FEMALE INFANTS

	Birth to 6 mos.	6 mos. to 12 mos.	12 mos. to 18 mos.	18 mos. to 24 mos.	Birth to 12 mos.	12 mos. to 24 mos.	Birth to 24 mos.
Shinn (1893)	31.5	13.7	9.0	6.5	49.5	16.1	73.5
McLeish (1898)		9.4					
Davenport and Drager (1936)		12.1	8.5	6.1		15.1	
Davenport (1938)		14.1					
Maresh and Washburn (1938):							
39		17.1	9.0	6.4		16.0	
45		13.9	7.9	8.7		17.3	
48		13.5	11.9	6.9		19.6	
50		18.0	9.3	8.5		18.5	
52		10.6	8.3	8.0		17.1	
55		10.9	6.3	7.9		14.8	
62		13.5	11.9	8.6		21.6	

TABLE XIb—(Continued)

	Birth to 6 mos.	6 mos. to 12 mos.	12 mos. to 18 mos.	18 mos. to 24 mos.	Birth to 12 mos.	12 mos. to 24 mos.	Birth to 24 mos.
Stuart (1939):							
A-3	30.0	12.5	8.0	7.0	46.3	15.5	69.0
B-2	26.6	12.6	10.6	5.8	42.6	17.0	66.9
A-2		12.5	8.8	7.4		16.9	
Gray and Faber (1940):							
B	45.1	9.8			59.4	13.6	81.1
A							66.0
Meredith (1941):							
W	34.5	13.3	10.6	7.2	52.4	18.6	80.7
R	33.4	13.1	9.7	8.5	50.9	19.1	79.7
Co	29.4	11.3	10.2	6.0	44.0	16.8	68.3
Ko	32.7	11.6	8.1	3.8	48.1	12.2	66.1
O	30.6	11.9	9.7	5.9	46.2	16.2	69.8
Mc	35.3	10.7			49.8		
A	28.2	12.6	8.8	6.0	44.3	15.3	66.4
Ri	32.4	13.5	10.1		50.2		

Selected findings are:

1. In every instance the increase is greater for the period from birth to six months than for the period from six to twelve months, greater for the latter half of the first year than for the period from twelve to eighteen months, and greater for the entire first year than for the second. With two exceptions, infants 45 and 55 from Maresh and Washburn (1938), the increments on each individual are larger over the age interval from twelve to eighteen months than over that from eighteen months to two years.

2. On the whole, individual differences in percentage gain are slightly more marked for females than for males. Over the four consecutive semiannual periods beginning with birth females vary from 26.6 per cent to 45.1 per cent; from 9.8 per cent to 18.0 per cent; from 6.3 per cent to 11.9 per cent; and from 3.8 per cent to 8.7 per cent. Female variation in percentage increase is from 42.6 to 59.4 for the interval birth to one year, 12.2 to 21.6 for the interval one to two years, and 66.0 to 81.1 for the interval birth to two years.

3. As with males, there is no consistent tendency for high rate of growth during one age period to be associated with high rate

of growth during the succeeding period, or vice versa. For females registering gains of less than 31 per cent between birth and six months, the average increase over the following half year is 12.2 per cent; for those showing gains of more than 33 per cent, the average increase is 11.7 per cent. On individuals with increments below 12 per cent and above 13 per cent over the latter half of the first year, the percentage increments spanning the first half of the second year average 8.5 and 9.9, respectively. Infants gaining under 9 per cent and over 10 per cent during the first half of the second year yield average percentage gains for the latter half of the second year of identical magnitude (6.9 per cent each). In annual terms, individuals exhibiting increases over the first year of less than 47 per cent or of more than 49 per cent afford average percentage increases covering the second year of 16.2 and 16.8.

4. For the period from birth to one year, the highest and lowest percentage gains in the Meredith (1941) series are those registered by subjects W (52.4) and Co (44.0). W was drawn from the managerial classes and Co from the professional. W was breast-fed for three weeks and Co for five and one-half months. W gave blood in her stools during the fourth week; had colds in the second, eighth, and ninth months; and in the twelfth month was sick for ten days with pneumococcus of both ears. Co was free from illness except for one slight cold at eight months. The gain of Meredith's subject A over the first postnatal year (44.3) was practically equal to that for subject Co. A was of the semiskilled socio-economic group; was fed at the breast throughout the year; did not receive orange juice prior to three months, cod liver oil before eight months, or egg yolk until the twelfth month; and gave an illness history of colds in the first, second and eighth months, of mild red measles in the third month, and of chicken pox in the tenth. For the interval from one to two years, similar percentage gains are shown for the Davenport and Drager (1936) infant and for infant A-3 from Stuart (1939). The former received "the vitamin requirements for growth" and, except for a mild respiratory infection during one week of her fourteenth month, developed "normally." The latter had "no illness other than infrequent colds or mild upper respiratory infections," but did not receive an adequate dietary (due principally to the fact that "excessive

amounts of carbohydrate'' were substituted for part of the milk requirements).

Association between absolute stature and rate of gain in stature

Employing two methodological approaches, Simmons and Todd (1938) studied the relationship between magnitude of stature and amount of stature increase. One approach was that of taking segments of the distribution for stature at age three months and computing the average gain over various age intervals for the infants composing each segment. Infants tall at three months of age—those constituting the highest one-fourth of the stature distribution—were found to make a smaller gain between ages three and six months than those composing the lowest (shortest) one-fourth of the distribution at age three months. Explicitly, the means were 5.7 cm. for the tallest one-fourth of each sex, and for the shortest, one-fourth, 6.8 cm. for males and 6.4 cm. for females. When the same segments for absolute stature at three months were studied with reference to gain in stature between three months and two years, no consistent relation was found between size and gain. For males, the tall quarter of the group gave a mean gain of 26.3 cm. and the shorter quarter a mean of 27.3 cm. For females, comparable means were 27.0 cm. and 26.5 cm., respectively.

The second approach consisted of obtaining coefficients of correlation for absolute stature at selected ages with gain in stature during ensuing periods of nine months and one year.

ASSOCIATION BETWEEN MAGNITUDE OF STATURE AND CENTIMETER GAIN IN STATURE

Absolute size (mos.)	Centimeter gain	Males Number	Males *r*	Females Number	Females *r*
Birth	Birth to 12	64	−.46	41	−.01
3	3 to 12	104	−.20	99	−.05
12	12 to 24	61	.20	57	.06

The three coefficients for females approximate zero, indicating an absence of relationship between size and gain during infancy. For males, the "negative coefficient between birth length and the birth to one year increment in length" implies a trend in the direction of smaller gains for the taller neonates and greater gains on the part of those short at birth.

It was possible to secure information on the relationship between absolute stature and percentage gain in stature using selected columns of the data presented in Tables Xa, Xb, XIa and XIb.

ASSOCIATION BETWEEN MAGNITUDE OF STATURE AND PERCENTAGE GAIN IN STATURE

Absolute size (mos.)	Percentage gain	Both sexes Number	Both sexes r	Value of r needed for significance at 5 per cent level
Birth	Birth to 12	25	$-.36 \pm .12$	$\pm .40$
12	12 to 24	39	$-.12 \pm .11$	$\pm .32$
Birth	Birth to 24	19	$-.39 \pm .13$	$\pm .46$

The samples are small, the probable error of the coefficients large, and the coefficients themselves in no instance statistically significant at the 5 per cent level of confidence. Consequently, the tabulation must be regarded as furnishing provisional, rather than precise, materials. There is the suggestion that infants tall at birth tend to grow in stature at a somewhat slower rate during their first postnatal year than infants short at birth. Further, there is the tentative indication that no significant relationship exists between stature at one year of age and rate of growth in stature during the second postnatal year.

STATURE OF INFANTS BORN PREMATURELY

Leading questions: To what extent does the average stature of premature neonates differ from that of full-term neonates? At age two years, are infants prematurely born any shorter than those born "at term"? Is the growth curve for stature over the period from birth to two years different on premature infants than on full-term infants?

Infants are designated "premature" through the use of various media. Among these are age; weight; stature; weight and stature; age, stature and weight. Age is commonly figured from the first day of the last maternal menstrual period. Sometimes it is calculated in calendar months and sometimes in lunar months. Occasionally "menstrual age" is converted to estimated "fertilization" or "fetal" age (*i.e.*, age of the organism). While the demarcation age between premature and full-term infants is not standardized, it is usually taken near thirty-seven weeks menstrual age or thirty-five weeks estimated fertilization age.

Probably the procedure most widely employed is that of regarding all infants weighing less than 2500 grams as premature. Some set the classification pivot at 2000 grams. The stature zone considered indicative of prematurity ordinarily is assigned an upper limit between 45.0 cm. and 47.0 cm.

One needs but a limited knowledge of individual differences in stature for age, or weight for stature, in order to appreciate that age, weight and stature are not strictly interchangeable media. This fact has been substantiated by Swanson, Lennarson and Adair (1936). In 10,660 consecutive births at the Chicago Lying-In Hospital during 1931-35, 6.1 per cent classified as "premature" on the basis of weighing 2500 grams or less, 4.9 per cent on the basis of the maternal gestation period being below thirty-seven weeks, and 6.4 per cent on the basis of measuring under 47.0 cm. in length. Of those "premature" by one or more of these tests, 30.1 per cent were so classified by weight but not by age, 20.2 per cent by stature but not by age, 9.8 per cent by weight but not stature, 12.9 per cent by stature and age but not weight, and 6.3 per cent by weight but not stature or age.

Menstrual age under 37 weeks

Measurements of stature on 77 premature neonates born in San Francisco between 1914 and 1921 were analysed by Cook (1921). Roughly four-fifths of the mothers were of northwest European descent. Their range in duration of gestation was 6.0 months to 8.5 months. Average stature was 42.4 cm., 8.0 cm. lower than the composite average (see page 14) for full-term White infants studied during the period 1910-25.

Forty-four of the 77 infants survived neonatal hospitalization. The average stature of this series was 43.4 cm. The youngest infant to survive was "born at 6 months, according to the history," and had a length of 41.0 cm. The shortest infant to survive was "31 cm. long at birth."

Blackfan and Yaglou (1933) obtained monthly increment values over a period of three months on "normal premature infants of a fetal age between 6 and 9 months." The infants were studied during 1926-29 under special housing and health care conditions afforded at the Infants' Hospital, Boston.

MONTHLY GAIN (cm.) IN STATURE OF PREMATURE INFANTS

Fetal Age	First Month		Second Month		Third Month	
at Birth (mos.)	Number	Mean Gain	Number	Mean Gain	Number	Mean Gain
Under 7	12	1.7	10	2.8	7	3.1
7 to 8	47	1.7	30	2.4	15	2.9
8 and over	33	1.6	18	2.5	4	2.6

This tabulation exhibits one finding by columns and one by rows. By columns, average increase in stature is markedly less during the first month than during the second, and somewhat less for the second than for the third. By rows, infants younger than seven fetal months at birth show a tendency to increase in stature at a slightly faster rate than infants over eight fetal months at birth.

The gains from Blackfan and Yaglou are appropriately compared with gains for a) intra-uterine fetuses of similar age and b) extra-uterine infants born at term. Under normal uterine conditions, the increment in stature of the average fetus between about six and eight months of age is upwards of five centimeters per month. For full-term White infants, the average monthly gains approximate 3.9 cm. between birth and one month, 3.3 cm. between one and two months, and 2.8 cm. between two and three months.

Stature data were reported by Dafoe and Dafoe (1937) on the Dionne quintuplets—five monozygotic females born prematurely by approximately two months. Detailed treatment of the parentage, care, dietary, and illness history of these infants is afforded in Part II. The tabulation which follows brings into juxtaposition the semiannual stature averages, and increases in average, for the Dionne series and for full-term White females of like postnatal age drawn from the middle and upper socio-economic classes during the period 1926-41 (see pages ~~14~~ 44 and 50).

STATURE DATA (cm.) FOR LIKE POSTNATAL AGES ON PREMATURE AND FULL-TERM FEMALES

	Average Magnitude				
	Birth	6 mos.	12 mos.	18 mos.	24 mos.
Dionne premature	33.9	55.2	69.1	76.6	79.3
1926-41 full-term	50.0	66.0	74.4	81.0	86.5

	Increase in Average Magnitude			
	Birth to 6 mos.	6 to 12 mos.	12 to 18 mos.	18 to 24 mos.
Dionne premature	21.3	13.9	7.5	2.7
1926-41 full-term	16.0	8.4	6.6	5.5

For absolute magnitude, the averages on the Dionne quintuplets are lower than the full-term averages by 16.1 cm. at birth, 5.3 cm. at one year of age, and 7.2 cm. at two years. For increase in magnitude, the quintuplets yield a gain over the first year following birth of 35.2 cm., or 10.8 cm. more than the centimeter gain for the full-term females. During the latter half of the second year, the average increment for the quintuplets is appreciably less than for the full-term females. In interpreting these comparisons it should be recognized that the full-term series is predominantly a single birth series, while the premature group is also a multiple birth group.

Birth weight below 2500 grams

Measurements of stature on 250 newborn infants with birth weights not exceeding 2500 gm. were analysed by Wilcox (1936). The data were gathered in New York City, 1929-34, on a ward sample two-thirds White and one-third Negro. Stature was less than 37.0 cm. for 5.6 per cent of the group, 37.0 cm. to 40.0 cm. for 10.0 per cent, 40.0 cm. to 43.0 cm. for 24.4 per cent, 43.0 cm. to 46.0 cm. for 58.4 per cent, and over 46.0 cm. for the remaining 1.6 per cent.

Swanson, Lennarson and Adair (1936), using a series of 655 infants with birth weights 2500 gm. or less, delivered in Chicago 1931-35, found 11.3 per cent to have statures not less than 47.0 cm. This percentage contrasts sharply with Wilcox's finding of only 1.6 per cent of a similar weight group measuring over 46.0 cm. Each study drew upon a total file for over 10,000 consecutive births. Incidentally, records of weight at birth not exceeding 2500 gm. constituted 6.1 per cent of the Chicago file but only 3.2 per cent of the New York City file.

Stature records on twelve male infants weighing between 1100 gm. and 2300 gm. at birth were reported by Gordon, Levine, Deamer and McNamara (1940) and by Gordon, Levine, McNamara, Marples and Benjamin (1941). The records were accumulated in New York City during 1937-40 on nine White males and three Negro males. Stature was taken from eight to forty-four days after birth. When measured, the weight range of the subjects was 1543 gm. to 2564 gm., and their average postnatal age was twenty-two days. Stature values for individual infants distributed themselves between 41.0 cm. and 47.5 cm., while the average for the group was 44.6 cm.

Blackfan and Yaglou (1933) analysed stature data on 464 "premature" infants. The data were collected during 1926-29 at the Infants' Hospital, Boston, on infants weighing less than 2500 gm. Both stature and weight were apparently obtained at various postnatal ages "from a few hours to several weeks." The stature records were distributed in four weight groups, and figures for central tendency and variability presented on each series.

STATURE (cm.) OF INFANTS IN VARIOUS WEIGHT GROUPS BETWEEN 680 AND 2500 GRAMS

Blackfan and Yaglou (1933)

Weight Group (gm.)	Number of Cases	Average Stature	Minimum Value	Maximum Value
680-1120	29	36.4	32.0	39.4
1130-1580	100	40.7	36.6	49.0
1590-2030	195	43.6	38.1	48.3
2040-2490	140	46.0	42.4	50.8

For the entire 464 cases taken together, the average stature (43.3 cm.) is practically identical with that obtained by Cook (1921) from forty-four infants prematurely born by two weeks to three months and surviving neonatal hospitalization.

A study was reported by Mohr and Bartelme (1934) on White infants weighing less than 2500 gm. at birth and having records for stature at different ages in the first two years. While the parents represented "a slightly inferior socio-economic group," the subjects were participants in an exceptional program of postnatal care and follow-up conducted through the Sarah Morris Hospital of Michael Reese Hospital, Chicago. The age of an infant was always taken as his statutory age minus the estimated amount of his prematurity. Mohr and Bartelme's averages are profitably compared with the composite averages (see p. 14) for full-term White infants studied during the period 1926-41.

ALIGNMENT OF AVERAGES ON PREMATURE INFANTS (AGE ADJUSTED) AND ON FULL-TERM INFANTS

Age (mos.)	Mohr and Bartelme, 1929-33		Composite White 1926-41	
	Number	Average	Number	Average
3	8	54.4	2062	60.2
6	11	63.2	1981	66.7
12	16	72.5	1714	75.3
18	49	80.8	1004	81.5
24	62	83.3	1050	87.0

The difference in stature narrows from 5.8 cm. at three months, through 3.5 cm. and 2.8 cm. at six and twelve months, to 0.7 cm. at eighteen months. This trend, in conjunction with the value of the average from Mohr and Bartelme at three years of age, suggests that their average at two years is spuriously low.

Measurements of stature at six months and one year after birth were secured by Schwarz and Kohn (1921) on infants with birth weights between 990 gm. and 2400 gm. The infants, 43 in all, were home deliveries given free supervision throughout the first year.

STATURE (cm.) AT SIX AND TWELVE MONTHS ON INFANTS WEIGHING BELOW 2400 GRAMS AT BIRTH

Weight Group (gm.)	6 mos.		12 mos.	
	Number of Cases	Average Stature	Number of Cases	Average Stature
990-1920	2	44.7	5	63.2
2000-2400	17	60.5	38	67.9

Compared with the composite averages for full-term White infants studied during the period 1910-25 (see p. 14), the averages for infants weighing between 2000 gm. and 2400 gm. at birth were lower by 5.7 cm. at six months and 5.3 cm. at one year. For the subjects weighing less than 2000 gm. at birth, "length at one year was never more than 64 cm.," *i.e.*, never equal to the average for full-term infants at six months.

Among a series of 18 infants examined by Capper (1928) at various extra-uterine ages from four to twenty-four months—all having birth weights not exceeding 2500 gm.—four were seen at ages eleven or twelve months. These four ranged in stature from 60.0 cm. to 65.5 cm. and gave a mean of 62.1 cm. Compared with the means at one year for the Dionne quintuplets and for the 43 cases studied by Schwarz and Kohn, this mean is lower by ~~6.9~~ 7.8 cm. and 5.3 cm. respectively.

Stature at birth less than 47 centimeters

In a series of 10,660 consecutive births at the Chicago Lying-In Hospital, 1931-35, Swanson, Lennarson and Adair (1936) found stature to be below 47.0 cm. on 6.4 per cent. For the same segment of the stature distribution ("length at birth of less than 47 cm."), percentages of 14.4 from 563 White infants and 26.1 from 544 Negro infants were obtained by Christie, Dunham, Jenss and Dipple (1941). Subgroup figures range from 9 per cent of the White multiparous males under 47.0 cm., to upwards of 30 per cent of the Negro primiparous infants under this value. These data were accumulated 1936-38 "in the ward service of the Johns Hopkins Hospital."

Peckham (1938) analysed stature records of less than 45.0 cm. accumulated at the Johns Hopkins Hospital over a forty-year period. In addition to yielding stature values of "less than 45 cm." the records were required to show a birth weight of "at least 1500 gm." These specifications were fulfilled by 6.1 per cent of "39,394 deliveries of theoretically viable children." Percentages from various subgroups were 4.0 for the White cases and 7.9 for the Negro; 3.6 for the White, "single birth" series and 7.3 for the Negro; 20.2 for the White "multiple birth" series and 35.2 for the Negro. For stature measurements of 40.0 cm. through 44.0 cm., the percentage frequencies were 2.9 and 6.0 on White and Negro infants from uniparous births, 16.0 and 26.4 on White and Negro infants from multiple births. The corresponding percentages for records 39.0 cm. or lower were 0.7, 1.3, 4.2 and 8.8, respectively.

RELATIONSHIPS BETWEEN STATURE AND DISEASE

Leading questions: With particular reference to infancy, is there an association between diabetes mellitus and tallness? Do infants having respiratory or digestive difficulties tend to be shorter than healthy infants? In which direction, and to what extent, do the gains in stature of infants with such diseases as rickets, scurvy, and tetany differ from those of physically normal infants?

Celiac disease

Stature data on infants under treatment for celiac disease during varying portions of the second postnatal year have been reported by Haas (1924) and by Stearns, Jeans, Catherwood and McKinley (1941). Haas treated a female infant over the entire

The averages given in rows 1 and 8 were obtained by Benedict and Talbot (1921) from data gathered 1915-17 on "clinically normal American children . . . mostly breast-fed." The data for rows 2 and 9 were collected in 1940 on infants fed exclusively until three months of age on breast milk, water, orange juice and cod liver oil. Roughly half the parents were engaged in professional occupations and half in unskilled or semiskilled occupations. One of the male infants received no vitamin D supplement and one of the female infants neither supplementary C nor D. Rows 3 and 10, from Francis (1940), portray infants "entirely or largely breast-fed for three months or more" and given vitamin supplements ("usually cod liver oil, orange juice, and a cereal containing vitamin B") "from an early age." These infants represent a moderately high level of socio-economic status. The Bakwin and Bakwin (1931) averages in row 11 are based on an unspecified number from among 475 "healthy" infants under one year of age living in homes of "moderate income" and periodically examined at a clinic for well infants. With reference to dietary, the infants were "partially or completely breast-fed from 3 to 6 months," received orange juice and cod liver oil after three weeks, and were given "egg yolk and vegetables or cereal by the fourth month."

Rows 4 and 5 are for "healthy male infants" studied under controlled conditions from the first postnatal month and fed milk formulas differently prepared but intended to be equivalent. In row 4 the formula was undiluted cow's milk and 6 per cent corn syrup, acidified with lactic acid. In row 5 it was "a mixture of equal parts of evaporated milk and 12 per cent corn syrup, acidified with lactic acid." Both groups received orange juice and cod liver oil daily, with an egg yolk being added to the daily diet at about four months. Jeans and Stearns (1933)—row 5—gave strained vegetables at five months, Nelson (1930) at six months.

The averages shown in row 6 from Raiford (1938), in row 14 from Hamil, Reynolds, Poole and Macy (1938), and in row 15 from Slyker, Hamil, Poole, Cooley and Macy (1937) were obtained on White and Negro infants of the indigent and near-indigent classes living in their own homes and receiving carefully prescribed and supervised diets. In each instance, the basic formula consisted of "evaporated milk, water and corn syrup acidified by the addition of commercially dehydrated lemon juice powder.'' Practically all infants of the two former samples received supplementary vitamin D, while the infants of the third sample were not given any vitamin D supplement.

Row 7 from Rhoads, Rapoport, Kennedy and Stokes (1941) is for White and Negro male infants of the lower income groups receiving ''evaporated milk as their sole source of milk.'' From an average age of six weeks, all of the infants were supplied daily supplements of vitamin C and D, approximately one-third supplementary vitamin A (''10 drops of carotene''), and about one-sixth the vitamin B complex (''0.5 tablespoonful of brewer's yeast powder''). The Elias and Turner (1936) averages of row 12 are also based on infants of the lower classes living in their own homes and fed prescribed diets. Here, however, the subjects were White infants of both sexes on a formula constructed from ''whole milk and water'' with dextrimaltose. ''All infants received orange juice after the first month and from October to May cod liver oil . . . cereal was added to the diet during the fourth month,'' pureed vegetables, egg yolk, and banana during the sixth.

The central tendency value at six months from Hess (1916)—row 13—is on ''normal infants'' fed continuously on a diet of pasteurized milk, sugar, and orange juice. Seemingly the infants were in residence at the Hebrew Infant Asylum, New York City. Row 16 depicts the average stature at ages three and six months of infants under continuous observation from their first month and fed ''unboiled, pasteurized, enzyme treated milk.'' In describing the preparation and digestibility of this milk, Blatt, Harris, Jacobs and Zeldes (1940) state that a ''pancreatic proteolytic enzyme'' was added to raw milk immediately prior to pasteurization, reducing the average curd tension from 26 (pasteurized milk) to 12.

There remains row 17 from Blatt and Schapiro (1935). Here infants ''in good health'' were placed on a controlled diet at ages between the first and the fourth months and followed to age six months. The diet consisted of whole boiled milk with dextrimaltose, orange juice and cod liver oil, cereal after age three months, and vegetables and soups from five months. Part of the group was given a special cereal mixture enriched with minerals and vitamin B_1.

Inspection of the entire tabulation shows that *under well supervised conditions:*

second year, a male infant from thirteen months to two years, and a female infant between seventeen months and two years. The diet prescribed consisted of "protein milk . . . pot cheese, broth, gelatin, banana, orange," white of egg, vegetables, and scraped or minced meat. Haas's special interest was to study the tolerance of celiac cases for carbohydrates in the form of ripe bananas. Stearns, *et al.* treated a single male infant over a period of approximately eighty days, beginning at eighteen months of age. After a ten-day observation period on a "normal" diet, the infant was placed on a diet high in protein, mineral and vitamin content, as low as practicable in fat, and with bananas as the main source of carbohydrate.

STATURE (cm.) OF FOUR INFANTS UNDER TREATMENT FOR CELIAC DISEASE

	12 mos.	18 mos.	20.7 mos.	24 mos.
Haas (1924):				
Female	67.0			81.0
Female		74.0		80.5
Male		74.0		81.0
Stearns, *et al.* (1941):				
Male		79.4	82.5	

Composite averages for clinically normal White infants studied 1910-25 are 73.2 cm. at one year, 79.3 cm. at eighteen months, and 84.2 cm. at two years (see p. 14). The measurements from Haas are markedly below these figures throughout. Similarly, the value of 79.4 cm. from Stearns, Jeans, Catherwood and McKinley is lower than the composite average of 81.5 cm. for White infants studied 1926-41.

For each of the four infants the gain in stature is higher than the average gain for clinically normal infants over a like age period. The magnitude of the advantage lies in the neighborhood of 3.0 cm. on the female treated for a year, 1.8 cm. on the two infants treated for upwards of six months, and 0.7 cm. on the male under treatment less than three months.

Diabetes mellitus

Infants with uncomplicated or subclinical diabetes mellitus have been studied with reference to stature by Bayer and Davis (1940), Boyd and Nelson (1928), John (1935) and White (1932). At one year of age, measurements are available on one subject each from Boyd and Nelson, John and White. The Boyd and Nelson infant was remeasured at eighteen months of age, following a six-month period on a diet affording slightly more than one gram of protein "for each pound of theoretical weight as determined by the height." At age two years, values for five subjects each are afforded by John and by White, while Bayer and Davis report the stature of a single male infant diagnosed as having "nondiabetic glycosuria," or diabetes mellitus "with definite reservations."

STATURE (cm.) OF DIABETIC INFANTS

	12 mos.	18 mos.	24 mos.		
	Record	Record	Cases	Average	Range
Boyd and Nelson (1928)	78.7	82.4			
White (1932)	74.4		5	97.8	
John (1935)	64.5		5	83.9	71.5-92.5
Bayer and Davis (1940)			1	90.9	

It appears probable that White's average at two years is an erroneous figure. This follows since it is a) higher by 3.8 cm. than the figure given by White for age three years, and b) over 4.0 cm. higher than the largest value obtained for the ninetieth percentile from any study of nonpathologic infants. A pooling of the remaining observations yields values at one year of 72.9 cm. (three cases) and at two years of 85.1 cm. (six cases). The composite averages representing normal White infants studied 1926-41 are 75.3 cm. at one year and 87.0 cm. at two year. Appropriating the phraseology of John, these comparisons neither support the view that diabetes is associated with excessive tallness nor confirm the less extreme position that at the time diabetes develops the child "almost without exception" is above average in stature.

Eczema

Bakwin and Bakwin (1931, 1939) have reported two studies pertaining to infants with "typical facial eczema." Both were carried out at the Bellevue Hospital, New York City. The earlier study presented averages derived from measurement of 41 experimental cases and 48 control ("healthy") cases between the age limits of eight and thirty-six weeks.

STATURE (cm.) OF INFANTS WITH FACIAL ECZEMA COMPARED WITH HEALTHY INFANTS

Age	Eczema		Healthy	
(weeks)	Number	Average	Number	Average
8 thru 11	5	57.6	13	53.7
12 thru 15	4	61.8	9	59.4
16 thru 19	5	64.1	8	61.2
20 thru 23	8	65.0		
24 thru 27	11	65.7	6	62.8
28 thru 31	4	66.7	9	64.0
32 thru 36	4	65.3	3	67.3

It follows from this comparison that, on the whole, the "infants with eczema are longer."

Graphic interpolation shows the average stature of the eczematous infants to approximate 60.9 cm. at three months of age. This figure is higher by 0.7 cm. than the composite average at three months for White infants studied 1926-41 (see p. 14). It exceeds the averages at three months from Bakwin, Bakwin and Milgram (1934), by 0.9 cm. when referred to the group under supervision through the Bellevue Hospital well-baby clinic, and by 2.6 cm. in the case of the Bellevue nonclinic series (see Table IIIa of the appendix). At six months of age, the average representing the eczematous infants (65.7 cm.) is larger than the Bakwin, Bakwin and Milgram nonclinic average by 0.8 cm., but *smaller than the 1926-41 composite average by 1.0 cm.* and smaller than the Bakwin, Bakwin and Milgram clinic average by 1.1 cm.

In their 1939 study, Bakwin and Bakwin employed larger samples of both infants with "typical facial eczema" and "healthy infants." The experimental series consisted of 130 infants "obtained from the wards or Out Patient Department of Bellevue Hospital," and the control series of 775 infants "admitted to Bellevue Hospital as healthy boarders or because of mild upper respiratory infections" and having "no regular medical supervision before admission." Sixty per cent of the 90 eczematous males had stature records above the mean for the control males. A parallel relationship held for 65 per cent of the 40 eczematous females. For both sexes jointly, "Infants with eczema were, on the average, slightly but significantly taller than the control group." In interpreting these findings it should be recognized that prior to hospitalization the control infants resided in a "poverty-stricken" district and in homes failing to avail themselves of accessible guidance on infant diet and health care.

Gastrointestinal disorders

Stature in relation to acute intestinal intoxication or other gastrointestinal difficulties has been studied by Bakwin and Bakwin (1931), Davenport (1938), Francis (1940) and Meredith (1941). Under the caption "acute intestinal intoxication," Bakwin and Bakwin listed averages for stature based on measurement of 129 infants ranging in age from birth to one year. Over one-third of the infants were "measured before the onset of illness," more than half failed to survive. The symptoms shown by different infants were itemized as "somnolence alternating with periods of hyper-irritability . . . convulsions, cyanosis, hyperpnea, oliguria or anuria . . . fever and an associated infection . . . diarrhea and vomiting." In the tabulation which follows, average values at selected ages are presented for three groups of Bellevue Hospital infants—the acute intestinal intoxication series, a group of "healthy" hospitalized cases used as a control series, and a group drawn by Bakwin, Bakwin and Milgram (1934) from the well-baby cinic.

STATURE (cm.) OF THREE GROUPS OF INFANTS STUDIED AT BELLEVUE HOSPITAL

Age	Infants with acute intestinal intoxication		"Healthy" hospital boarders		Infants enrolled in well-baby clinic	
(weeks)	Cases	Av.	Cases	Av.	Cases	Av.
0 thru 3	12	50.7	31	51.6	190	52.4
4 thru 7	34	52.3	19	53.2	130	54.8
8 thru 15	35	54.0	22	56.5	150	59.5
16 thru 23	21	61.0			103	64.1
24 thru 31	10	63.1	15	63.5	83	67.8
36 thru 43	7	65.5	12	69.0	61	71.3

Finding: "Infants with acute intestinal intoxication are, on the average, shorter than . . . healthy infants" (pp. 396-7).

Stature records at one, three, and six months of age were published by Davenport on a single male infant having acute intestinal intoxication during the early part of the second month. The infant was described as "of American descent" and as being fed so that "the vitamin requirements for growth were satisfied." Compared with the composite averages for White males from the middle and upper socio-economic levels studied 1926-41 (see p. 44), the infant was taller by 0.4 cm. at one month, shorter by 2.0 cm. at three months, and taller by 0.4 cm. at six months. Transposing into increment terms, the infant's gains in stature were 2.4 cm. less than average between one and three months and 2.4 cm. above average between three and six months.

Utilizing stature data at quarterly age intervals from three months to one year, Francis compared 50 infants (25 of each sex) having "some difficulty in gastrointestinal adjustment" with 100 infants (50 of each sex) free from "prolonged or severe illness." Both groups were drawn from moderately high level homes, were partly breast-fed, and "from an early age received vitamin supplements." The experimental group included infants with disorders ranging from mild eczema to pylorospasm.

STATURE (cm.) OF INFANTS HAVING GASTROINTESTINAL DIFFICULTIES COMPARED WITH CONTROLS

Group	3 mos.		6 mos.		9 mos.		12 mos.	
	Cases	Av.	Cases	Av.	Cases	Av.	Cases	Av.
Gastrointestinal	50	60.0	50	66.3	50	70.8	50	74.9
Healthy	100	59.8	100	66.3	100	71.1	100	75.2
1926-41 composite	2062	60.2	1981	66.7			1714	75.3

The averages from Francis are supplemented with the composite values for White infants measured 1926-41 (see p. 14). At no age can the differences be regarded as statistically significant. The figures at one year of age exceed those for three months by 14.9 cm., 15.4 cm., and 15.1 cm., respectively.

The marked difference in average stature between the experimental groups of Francis and of Bakwin and Bakwin is possibly attributable in part to the greater degree of severity of the disorders for the latter, and in part to the sustained pediatric supervision of the former and the consequent early recognition and competent handling of difficulties.

Measurements of stature at birth and six months following were obtained by Meredith on a single male infant having a health history of excessive vomiting during the first postnatal month and an operation for pyloric stenosis at one month. The infant's parents were of northwest European ancestry and of the unskilled occupational group. Stature was 50.0 cm. at birth and 68.5 cm. at six months. The increase in stature was 18.5 cm., or 1.4 cm. greater than the increase in average stature for White males of the middle and upper socio-economic levels measured 1926-41 (see p. 50).

Respiratory infections

Fragmentary findings for growth of stature in relation to such conditions as coryza, pharyngitis, laryngitis, bronchitis and pneumonia have been reported by Davenport (1938), Jeans and Stearns (1938), Meredith (1941), Stearns, Jeans and Vandecar (1936) and Wolf and Sherwin (1923). Wolf and Sherwin secured stature measurements at ages three and six months on an individual infant developing a cold during the fourth month and recovering slowly. Unfortunately, more specific information regarding the severity and duration of the chronic condition was not afforded. The infant was artifically fed, receiving "raw milk" supplemented with orange juice. Stature at three months was 58.2 cm., or 2.3 cm. less than the composite average for White infants examined during 1910-25 (see p. 14). Increase in stature from three to six months was 4.8 cm., or 0.9 cm. less than the difference between the composite figures for three and six months.

A stature curve considered to exhibit the "effect" of respiratory illness is available from Stearns, Jeans and Vandecar. The subject was a male infant of Scandinavian stock living under a well controlled dietary and health care schedule from the latter part of the second month. The curve shows a deflection following forty weeks of age associated with the period of "a severe illness, a laryngitis requiring tracheotomy, wherein the child was critically ill for a period of several days and moderately ill for a month or more." Notwithstanding, over the period from nine to twelve months the gain in stature was 3.6 cm., or within 0.3 cm. of the increase in average stature from nine to twelve months for White males of the middle and upper classes measured 1926-41 (see p. 50). Also relevant is the observation that despite this illness, a mild chickenpox infection about six months, and the fact that the child was "always unusually susceptible to respiratory infection," the stature of the infant at one year was 80.0 cm.—3.6 cm. above the 1926-41 composite average.

Six individual stature curves for infants having respiratory infections (one of which was reproduced from the Stearns, Jeans and Vandecar paper) were published by Jeans and Stearns. These curves covered varying age segments within the first postnatal year. Their fluctuations, in conjunction with the associated illnesses, were described as follows:

> ". . . following an attack of acute bronchitis of two weeks' duration, the growth of infant Ha completely ceased for a period of four weeks; a similar cessation of linear growth was observed in infant B after acute laryngitis requiring tracheotomy. Both infants subsequently compensated entirely for the termporary slowing of growth. Bronchitis followed by mild middle ear infection caused cessation of growth for six weeks in infant Ho. On the other hand, acute bronchitis in infant T and pneumonia in infant P, both young infants, caused a slowing of growth for only about two weeks, while bronchitis followed by middle ear infection caused little or no slowing of growth until after seven weeks of illness for infant M" (p. 731).

Davenport took measurements of stature at monthly intervals from nine to twelve months of age on a single male infant having chronic nasopharyngitis beginning about the middle of the tenth month and acute otitis media six weeks later. The infant was of Scotch-Irish descent and was so fed from birth that "the vitamin requirements for growth were satisfied." There was no irregularity in the stature trend. In serial order, the values for nine, ten, eleven and twelve months were 76.6 cm., 78.2 cm., 79.6 cm., and 80.7 cm. The values at nine and twelve months are higher by 4.1 cm., and 4.3 cm. than the averages at these ages for White males pooled to represent the middle and upper classes for the period 1926-41 (see p. 44).

Stature data over age intervals embracing a period of respiratory infection were secured by Meredith on four infants. Two of the infants, L and S, were measured at ages three and six months. Both were male infants of northwest European ancestry whose fathers were employed as unskilled or semiskilled laborers. L had a severe cold lasting most of the fifth month. S had a cold in the fifth month followed by severe croup lasting for four weeks—during these weeks S was described as "a very sick, restless baby."

STATURE DATA (cm.) FOR TWO MALES WITH RESPIRATORY INFECTIONS AND A CONTROL SERIES

	3 mos.	6 mos.	Increase from 3 to 6 mos.
Infant L	61.5	67.6	6.1
Infant S	60.4	68.1	7.7
1926-41 Composite	61.2	67.9	6.7

Compared with the increase in average stature for male infants of the middle and upper classes studied 1926-41, the gain made by L was lower and that for S higher.

The two remaining infants, Mc and M, were older. Mc was a female of northwest European descent whose father was a university instructor. Between six months and one year of age she had colds over one-third of the time. Three colds lasted two weeks each, while one was severe and more prolonged. Stature was 67.1 cm. at six months and 7.2 cm. higher at one year. The composite averages for White females of the middle and upper classes measured 1926-41 are 66.0 cm. at six months and 8.4 cm. higher at one year. M was a male infant of northwest European stock whose father was a semiskilled workman. Between twenty-one months and two years of age he had bronchitis for three weeks (with a temperature for one week of 101° to 103°) followed by a cold for another two weeks. Stature was 86.3 cm. at twenty-one months and 3.3 cm. greater at two years. From the pooling of White males representing a moderately high socio-economic level in the period 1926-41, the average is 85.4 cm. at twenty-one months and 2.7 cm. greater at two years.

Rickets

The growth in stature of rachitic infants has been studied by Davenport (1938), Eliot, Nelson, Barnes, Browne and Jenss (1936), Robinson (1940) and Woodbury (1921). Woodbury accumulated stature measurements on 344 White infants "diagnosed as having rachitis." His data were collected in California and New York City during 1918-19. Differences were computed between these stature records and the "Children's Year" averages from nonrachitic White infants measured in California and New York City. The 139 rachitic subjects under one year of age gave an average 1.6 cm. (2.4 per cent) shorter than the nonrachitic series. Over the age interval from one to two years, the average stature of the nonrachitic series exceeded that of the rachitic (205 cases) by 2.7 cm., or 3.6 per cent.

Davenport published stature measurements on a single male infant for whom roentgenograms at age nine months showed slight rickets. The infant was of Scotch-Irish descent and was one of a group of infants considered so fed that "the vitamin requirements for growth were satisfied." Stature at nine months was 77.3 cm.—4.8 cm. greater than the composite average from 1926-41 White males of the middle and upper socio-economic groups (see p. 44). Gain in stature between six and nine months was 4.4 cm.; the difference between the composite averages at these two ages is 4.6 cm.

Robinson studied the incidence of rickets from different "types of vitamin D administration" and the growth in stature of rachitic infants. The subjects were 208 "normal, healthy infants" (184 White, 24 Negro) born at two St. Louis hospitals during 1937-39. They were studied over the first six months of postnatal life. Out of 79 infants receiving five drops of viosterol daily (800 to 1000 U.S.P. units of vitamin D), 26.6 per cent showed roentgenographic evidence of rickets at one or more examinations. Average gain in stature was 13.5 cm. for the full 79 cases and 13.7 cm. for the rachitic subgroup. Of the remaining 129 infants fed irradiated milk assaying 135-200 U.S.P. units of vitamin D to the reconstructed quart but imbibing "no more than 75 per cent of the possible quart" daily, 37.2 per cent presented evidence of rickets. Here, average gains in stature were 15.4 cm. and 15.7 cm. Disregarding dietary differences, the average gain was 14.7 cm. for the entire sample of 208 infants and 15.1 cm. for that third (33.2 per cent) of the sample yielding roentgenographic evidence of rickets.

Employing 567 Detroit infants between the age limits of one week and nine months, Eliot, Nelson, Barnes, Browne and Jenss studied the incidence of rickets in relation to gain in stature and vitamin D dosage. The infants, 335 White and 232 Negro, were born 1933-35 and were under observation in their own homes. They were studied only "during the winter (September to May) when the influence of sunlight was almost negligible" and were regularly supplied an "antirachitic substance"—either viosterol, cod liver oil or vitamin D milk. Incidence of rickets was determined from roentgenograms of the forearm bones. Percentage incidence was 33.4 for the White infants and 25.0 for the Negro. For 10 infants only did the "advance in the rachitic process" exceed a "slight degree." Subgrouping of the rachitic cases by vitamin D dosage and zone of stature gain showed a) of the 88 cases receiving less than 400 U.S.P. units of vitamin D daily (average dosage around 275 units), 45.5 per cent increased in stature more than average (reference was made to the average for a given race and sex without regard to vitamin D dosage or incidence of rickets) and 54.5 per cent less than average, and b) of the 82 cases prescribed more than 400 U.S.P. units of vitamin D daily (average dosage about 1000 units), 57.3 per cent increased more than average and 42.7 per cent less than average. For the infants in the lower dosage group, there was a slight tendency for slow growth to be associated with high incidence of rickets; for the infants in the higher dosage group, the opposite tendency of rapid growth associated with high incidence of rickets was indicated. In the language of the authors, "More detailed study of the whole question is needed before definite conclusions concerning the relationship of growth in length to the incidence of rickets can be drawn" (p. 369).

Scurvy

Infants with "preclinical" or "subacute" scurvy have been investigated regarding growth in stature by Hamil, Reynolds, Poole and Macy (1938) and by Hess (1916). On each of two infants, the latter reported stature increments during a period considered to represent "subacute scurvy" and during antecedent and subsequent control periods. The occurrence of several cases of scurvy "in an institution where the use of orange juice was discontinued" had led Hess to the view that infantile scurvy was produced through the elimination of orange juice from the infant's diet and eradicated by supplementing the diet with orange juice. The infants were fed a basal diet of pasteurized milk, sugar and cereal throughout. Their gains in stature were obtained over age intervals "when they were receiving orange juice, when the orange juice was discontinued, and when this juice or the juice of the orange peel was again added to the diet." One infant, observed from seven to eighteen months of age, gained over 4.0 cm. during an initial two months on orange juice, 4.0 cm. during the following six months in which no orange juice was given, and over 4.0 cm. during three months after the antiscorbutic agent was again a part of the diet. The other infant, observed from ten to twenty-one months, gained slightly more than 2.5 cm. during the preliminary two months on orange juice, 4.0 cm. during the next half year, and, with the resumption of orange juice, over 4.0 cm. the following quarter year. For the age intervals corresponding to the six-month periods when orange juice was discontinued, the composite trend for White infants measured 1910-25 (see p. 14) yields gains of 6.4 cm. and 6.1 cm. For the succeeding quarter-year periods the composite increases are 3.0 cm. and 2.6 cm., respectively. These comparative values harmonize with Hess's conclusion that growth in stature is "retarded during the protracted development of infantile scurvy," while "supergrowth" follows "the addition of the essential foodstuff."

On the basis of "minute roentgen changes," Hamil, Reynolds, Poole and Macy diagnosed 21 of a series of 427 infants under one year of age as having "mild" or "preclinical" scurvy. The subjects were infants of "indigent or near-indigent parents" living in their own homes, but receiving dietary supervision from roughly one month after birth. The basal formula prescribed was "acidified by the addition of commercial dehydrated lemon juice." After three months of age, an effort was made to maintain the daily intake at approximately 2000 International units of vitamin C. Comparison of curves for average stature on the total series and on the scurvy subgroup was stated to show "a slight difference" in favor of the former. "Twelve of the 21 infants showed slowing rate of growth in length before scurvy was evident . . . 18 showed slowing or cessation of gain at the time scurvy was manifest" (p. 575). All 21 cases were stated to have recovered spontaneously and to have "resumed the normal rate of gain after disappearance of the roentgen signs of scurvy."

Heart abnormality, infected tonsils and adenoids, marasmus, obesity, tetany, tuberculosis

Woodbury (1921) studied stature in relation to "heart abnormality," "diseased or enlarged tonsils," and "adenoids." The data were collected as part of an extensive series of records amassed in 1918-19 through a program sponsored by "the Children's Bureau and the Woman's Committee of the Council of National Defense." From over 27,000 White infants examined in California and New York City, 2310 were "diagnosed as having either diseased or enlarged tonsils," 921 as having "adenoids," and 73 as having some form of heart abnormality. Differences were obtained between the statures of infants with each type of defect and average values for the total series of White infants measured in California and New York City.

"RELATION OF DEFECT TO STATURE" (cm.) FOR THREE "CHILDREN'S YEAR" SUBGROUPS

Age (mos.)	Number of Subjects	Defect subgroup minus Average for total sample
	Heart Abnormality	
Under 12	34	−1.9
12 to 24	39	− .9
	Adenoids	
Under 12	304	1.2
12 to 24	617	.3
	Enlarged or Diseased Tonsils	
Under 12	662	1.4
12 to 24	1648	.3

For infants less than one year of age, those with infected tonsils and adenoids were slightly taller, and those with "heart abnormality" slightly shorter, than the average for the total series. For the age group encompassing the second year, all differences were reduced appreciably and none was statistically significant.

Measurements of stature were published by Levine, Wilson and Gottschall (1928) for five marantic infants "all markedly emaciated, being in every instance 47 per cent or more underweight." These data are appropriately placed beside central tendency figures at like ages on male and female infants measured over the period 1850-1941. The 1850-1941 figures (see p. 43) may be taken as typifying White infants negative for infantile marasmus and other gross pathological states.

STATURE (cm.) OF MARANTIC INFANTS COMPARED WITH COMPOSITE AVERAGES FOR 1850-1941

Age (mos.)	Sex	Infants with marasmus	White infants 1850-1941	Marasmus minus 1850-1941
2.5	Female	53.5	58.5	− 5.0
4.5	Male	57.0	64.5	− 7.5
5	Male	55.0	65.5	−10.5
5	Male	55.5	65.5	−10.1
9.5	Male	62.5	71.6	− 9.1

Four of the infants with infantile marasmus fall between the age limits of four and ten months. Compared with the typical stature of males of the same ages measured 1850-1941, these are shorter by an average of 9.3 cm., or over three and one-half inches. For their positions with reference to the stature distributions of non-pathological infants see pages 45-46.

The stature of a single "obese" infant at two years of age was recorded by Bruch (1939). The subject was a female weighing 23.6 kg. Stature was 94.6 cm.—8.1 cm. higher than the average for White females from the middle and upper socio-economic groups measured 1926-41 (see p. 44). That 94.6 cm. at age two years portrays an extremely tall female is attested by the fact that the column of Table IXc, headed "Maximum Value" contains no female figure for the period 1926-41 higher than 93.9 cm.

Bakwin and Bakwin (1931) obtained stature measurements on 45 infants with tetany (28 males, 17 females) "in whom the serum calcium concentration was below 8.0 mgm. per cent" (p. 396). The subjects ranged in age between two and eleven months. In the tabulation which follows there are aligned the averages for the tetany series and for two control groups studied at the same institution—one group of "healthy" hospitalized infants and a second group of infants enrolled in the "well-baby" clinic. The clinic values are from Bakwin, Bakwin and Milgram (1934).

STATURE (cm.) OF THREE GROUPS OF INFANTS STUDIED AT BELLEVUE HOSPITAL

Age (weeks)	Infants with tetany		"Healthy" hospital boarders		Infants enrolled in well-baby clinic	
	Cases	Av.	Cases	Av.	Cases	Av.
8 thru 11	4	53.1	13	53.7		
16 thru 23	14	60.0			103	64.1
24 thru 31	10	63.8	15	63.5	83	67.8
32 thru 39	11	66.6	8	68.6	75	70.2
44 thru 47	5	69.3	3	69.0		

While not consistently lower than the averages for Bellevue Hospital "healthy" boarders, the averages for infants with tetany are appreciably lower than those for infants enrolled at the Bellevue well-baby clinic.

Averages for stature at two years of age were reported by Blatt (1921) on 12 tuberculous and 25 control infants. The latter were obtained through the West Side Jewish Aid Dispensary, Chicago, and were either "without any symptoms suggestive of tuberculosis" or "negative to tuberculin tests." The former were apparently measured on admission to the West Side Jewish Branch of the Municipal Tuberculosis Sanitarium. Both groups were from " a small district in which hygienic, dietetic, economic, and social conditions were decidedly adverse." The tuberculous group gave an average stature of 82.8 cm. and the nontuberculous of 83.6 cm. The average for the infants having tuberculosis is lower by 1.4 cm. than the composite average at two years for well infants measured 1910-25 (see p. 14).

Summary

What are the principal findings from the foregoing treatment of relationships between stature and disease? A succinct reply to this question appears best secured by giving separate summaries of the findings for absolute stature and the findings for rate of growth in stature. With reference to the latter,

1. Jeans and Stearns (1938) have presented data on six infants indicating that respiratory infection may be associated with temporary (two to six weeks) slowing or cessation of growth in stature.

2. A temporary slowing or cessation of stature growth has been reported by Hamil, Reynolds, Poole and Macy (1938) for

18 of a group of 21 infants considered to show roentgenographic evidence of mild scurvy.

3. After studying 170 infants roentgenographically diagnosed as having slight rickets, Eliot, Nelson, Barnes, Browne and Jenss (1936) have taken the position that "definite conclusions concerning the relationship of growth in length to the incidence of rickets" must await additional investigation.

4. During varying periods of treatment, four infants with celiac disease (Haas, 1924; Stearns, Jeans, Catherwood and McKinley, 1941) have been shown to gain in stature at a faster rate than clinically normal infants.

The more extensive findings for absolute stature may be brought together in a tabulation comparing the stature of infants having various diseases with the stature of nonpathologic infants.

STATURE OF INFANTS WITH DIFFERENT DISEASES IN RELATION TO COMPOSITE AVERAGES FOR CLINICALLY NORMAL INFANTS

Disease Condition	Stature Relative to Nonpathologic Infants	Investigator and Subjects
	AGE PERIOD: BIRTH TO ONE YEAR	
Marasmus (Athrepsia)	Shorter by two to four inches	Levine, Wilson and Gottschall (1928); five infants
Tetany (Spasmophilia)	Shorter by about one and one-half inches*	Bakwin and Bakwin (1931); 45 infants
Moderately severe rickets	Shorter by more than one-half inch	Woodbury (1921); 139 non-hospitalized infants
Slight rickets (X-ray diagnosis)	Probably similar to nonpathologic	Davenport (1938); see also Robinson ('40); 70 infants
"acute intestinal intoxication"	Short by about one and one-half inches*	Bakwin and Bakwin (1931); 129 infants, less than half recovering
Gastrointestinal "difficulty" (eczema to pylorospasm)	Similar to normal infants	Francis (1940); 50 infants, none failing to survive and none hospitalized at age one year
"typical facial eczema"	Similar to normal infants*	Bakwin and Bakwin (1931); 41 infants
Respiratory infections (mild to moderately severe)	Similar to normal infants	Davenport (1938), Meredith (1941), Stearns, Jeans and Vandecar (1936), Wolf and Sherwin (1923); seven infants

Disease Condition	Stature Relative to Nonpathologic Infants	Investigator and Subjects
	AGE PERIOD: ONE TO TWO YEARS	
Celiac disease	Shorter by one to two inches	Haas (1924), Stearns, Jeans, Catherwood and McKinley (1941); four subjects
Moderately severe rickets	Shorter by one inch	Woodbury (1921); 205 non-hospitalized subjects
Diabetes mellitus	Shorter by nearly an inch	Bayer and Davis (1940), Boyd and Nelson (1928), John (1935) and White (1932); nine subjects
Tuberculosis	Shorter by about one-half inch	Blatt (1921); 12 subjects
Infected or enlarged tonsils, adenoids	Similar to normal infants	Woodbury (1921); 1648 subjects (tonsils) and 617 subjects (adenoids)
Obesity	Taller by three inches	Bruch (1939); single subject, extremely tall

---

*The reader is cautioned against misinterpreting this statement. It represents a comparative finding with reference to the composite trend of average stature for clinically normal infants studied in the period 1926-41. It does not constitute a comparative finding with reference to Bakwin and Bakwin's "healthy" hospital boarders.

STATURE IN RELATION TO DIET

Leading questions: Do infants breast-fed during the early postnatal months tend to be taller than infants artificially fed? Are some forms of cow's milk associated with larger gains in stature than other forms? Do infants given one to three teaspoonfuls of cod liver oil daily show greater stature growth than infants receiving one-half teaspoonful of cod liver oil or 50-150 U.S.P. unit irradiated milk? Is there a positive relationship between rate of growth in stature and early inclusion in the dietary of supplementary minerals and/or the vitamin B complex?

Source and form of milk

Wolf and Sherwin (1923) obtained individual protocols for stature on two infants artificially fed from two weeks after birth to six months of age. One infant received "raw milk" and the other "sweetened condensed milk" supplemented with orange juice.

SERIATIM STATURE DATA (cm.) FOR TWO INFANTS FED DIFFERENT FORMS OF COW'S MILK

Milk	Size			Gain	
	1 mo.	3 mos.	6 mos.	1 to 3 mos.	3 to 6 mos.
Raw	54.9	58.2	63.0	3.3	4.8
Sweetened condensed	53.8	56.1	58.2	2.3	2.1

Compared with the composite average at age six months for White infants studied during the period 1910-25 (see p. 14), the infant fed raw milk was shorter by 3.2 cm. and the infant fed sweetened condensed milk shorter by 8.0 cm. Incidentally, Wolf and Sherwin stated that the subject fed condensed milk was free from illness during the entire period of the experiment and its "bone and tissue development appeared to be normal in every way."

For breast feeding, individual stature records extending from birth to six months are available from Stuart (1939) and Meredith (1941) on three female infants of the professional classes and on two males and one female of the unskilled and semiskilled classes.

SERIATIM STATURE DATA (cm.) FOR SIX INFANTS FED HUMAN MILK

Subject	Size			Gain	
	Birth	3 mos.	6 mos.	Birth to 3 mos.	3 to 6 mos.
	Females: Professional classes				
B-3	50.7	60.2	66.7	9.5	6.5
O	52.0	62.2	67.9	10.2	5.7
Co	50.4	59.8	65.2	9.4	5.4
	Female: Unskilled classes				
A	49.7	58.7	63.7	9.0	5.0
	Males: Unskilled classes				
Mo	50.5	60.4	66.8	9.9	6.4
Re	50.0	61.5	68.2	11.5	6.7

The only infant not breast-fed for the full six months was Co, who was weaned at 5.5 months. Infants B-3 and Co received vitamin C and D supplements from the first month, infants O and Mo from two months. Neither A nor Re were given any vitamin

D supplement. Re received orange juice from two months, A from three months. Egg yolk was added to the diet of O in the third month and of Co and Re in the fifth month.

In the tabulation which follows stature values for ages up to six months are presented on *groups* of infants fed either human milk or one of the different forms of cow's milk.

AVERAGE STATURE AND GAIN IN AVERAGE STATURE (cm.) FOR INFANTS FED VARIOUS MILKS

	Average:				Increment:	
	3 mos.		6 mos.		Birth to	3 to
	Cases	Av.	Cases	Av.	3 mos.	6 mos.
	MALES					
	Human milk studies					
1. Benedict and Talbot (1921)	13	60.8	12	67.3		6.5
2. Meredith (1941)	5	60.7			10.4	
3. Francis (1940)	25	60.3	25	66.7		6.4
	Cow's milk studies					
4. Nelson (1930)	9	61.8	8	69.3		7.5
5. Jeans and Stearns (1933)	9	61.4	6	68.4		7.0
6. Raiford (1938)	240	60.8	209	67.8		7.0
7. Rhoads and others (1941)	233	59.2	233	66.2		7.0
	BOTH SEXES					
	Human milk studies					
8. Benedict and Talbot (1921)	26	60.3	24	65.7		5.4
9. Meredith (1941)	9	60.3			10.1	
10. Francis (1940)	50	59.8	50	66.2		6.4
11. Bakwin and Bakwin (1931)	---	59.4	---	67.5		8.1
	Cow's milk studies					
12. Elias and Turner (1936)	52	60.3	59	67.1		6.8
13. Hess (1916)			10	66.7		
14. Hamil and others (1938)	393	60.2	374	66.6		6.4
15. Slyker and others (1937)	c.55	59.8	c.50	65.3		5.5
16. Blatt and others (1940)	37	58.9	11	66.3		7.4
17. Blatt and Schapiro (1935)			c.45	64.6		

1. Infants fed pasteurized or evaporated cow's milk beginning at ages under one month are no shorter in average stature at age three months than infants receiving breast milk. (On pooling the samples for "both sexes," composite means are obtained of 60.1 cm. from the former and 60.0 cm. from the latter).

2. Gain in average stature between three and six months of age is not appreciably different for infants fed human milk than for those given evaporated or pasteurized milk. (For infants of "both sexes," the mean of the gains is 6.5 cm. for the latter and 6.6 cm. for the former.)

From a study made "in the nursery wards of the Florence Crittenden Hospital, Detroit," Hoobler (1931) reported average gains in stature "during a twenty-eight day period" of 2.5 cm. for a breast-fed group and 2.1 cm. for a group fed "whole milk dilutions" with added dextrimaltose. It was not specified whether the two groups were equated for age.

Rapoport and Stokes (1936) compared the average gain in stature of eight infants receiving evaporated milk, diluted 50 per cent with water, and of six infants receiving undiluted whole milk. Both milks were irradiated and supplemented with corn syrup. Alternate infants were given orange juice or cevitamic acid, 2 per cent ferric ammonium citrate being added in each case. The evaporated milk group gained 11.2 cm. between the ages of 2.2 and 6.7 months. For the whole milk group the average gain was practically identical—11.4 cm. from 2.0 to 6.5 months.

The average gain in stature over a six-month period of infants prescribed human milk, evaporated milk, and whole milk was investigated by Robinson (1940). For 37 infants breast-fed a minimum of three months, and 42 infants fed evaporated milk throughout—all supplied a daily dosage of five drops of viosterol in oil—the average gains obtained were 12.8 cm. and 14.1 cm., respectively. Parenthetically, roentgenographic evidence of rickets occurred only once in the breast-fed group and twenty times in the cow's milk group. For 51 infants receiving irradiated evaporated milk and 25 given comparably irradiated whole milk, the average gains in stature were 15.2 cm. and 17.5 cm., respectively. In all groups the subjects were "normal, healthy infants" started on orange juice by six weeks of age and given cereal after reaching a weight of 12 to 13 pounds. Unfortunately, it was not explicitly stated whether the different groups were equivalent in age.

Amount and medium of supplementary vitamin D

The relationship in infancy between growth in stature and various additions of vitamin D to the diet has been investigated by Eliot, Nelson, Barnes, Browne and Jenss (1936), Jeans and Stearns (1938), Peatman and Higgons (1938), Rapoport and Stokes (1936), Rhoads, Rapoport, Kennedy and Stokes (1941), Robinson (1940), Slyker, Hamil, Poole, Cooley and Macy (1937) and Stearns, Jeans and Vandecar (1936). In some instances findings were reported for absolute stature, in others attention was restricted to gain in stature, and in still others consideration was given to both size and gain. The averages for absolute stature at successive quarterly ages from three months to one year are assembled in the following tabulation.

AVERAGES FOR STATURE (cm.) ON INFANTS GIVEN DIFFERENT DOSAGES OF VITAMIN D

	Daily Dosage (U.S.P. units)	3 mos. Cases	3 mos. Av.	6 mos. Cases	6 mos. Av.	9 mos. Cases	9 mos. Av.	12 mos. Cases	12 mos. Av.
	WHITE MALES								
	Controlled intake studies								
1.	1800-4600	3	61.0	2	68.0				
2.	340-400	35	60.3	21	68.3	14	73.2		
3.	60-135	4	59.3	4	67.1				
	Prescribed intake studies: Middle and upper classes								
4.	1600-9000	183	61.5	156	68.6	122	73.2	144	76.7
	Prescribed intake studies: Lower classes								
5.	1500	42	58.7	42	65.7	42	70.4	42	73.9
6.	110	48	59.9	48	66.5	48	71.0	48	74.4
	BOTH SEXES								
	Controlled intake: White infants								
7.	1800-4600	7	60.7	4	67.0				
	Prescribed intake: White infants, middle and upper classes								
8.	1600-9000	343	60.9	303	67.5	238	72.2	296	75.5
	Prescribed intake: White and Negro infants, lower classes								
9.	250-810	c.270	60.3	c.250	66.9	c.220	72.0	c.180	76.0
10.	95-152	c.70	59.9	c.70	66.3	c.60	71.3	c.45	74.6
11.	None	c.55	59.8	c.50	65.3				

Sources used in compiling this tabulation were: For rows 1 and 7, Jeans and Stearns (1938); for rows 2 and 3, Stearns, Jeans and Vandecar (1936); for rows 4 and 8, Peatman and Higgons

(1938); for rows 5 and 6, Rhoads, Rapoport, Kennedy and Stokes (1941); and for rows 9, 10, and 11, Slyker, Hamil, Poole, Cooley and Macy (1937). Without exception, the dosage levels shown were administered or prescribed beginning not later than the third month after birth. Findings for the latter half of the first year are:

1. Infants given less than 150 U.S.P. units of supplementary vitamin D daily tend to be *slightly shorter* in average stature than those receiving a supplement of between 250 and 850 U.S.P. units. At six months of age, the average stature from Stearns, Jeans and Vandecar for male infants ingesting from 60 to 135 U.S.P. units of vitamin D daily in the form of irradiated milk (row 3) is 1.2 cm. lower than their average (row 2) for male infants given 340 to 400 units ("the equivalent of one teaspoonful of cod liver oil") daily. At ages six months to one year, the Slyker, Hamil, Poole, Cooley and Macy averages are from 0.6 cm. to 1.4 cm. higher on infants prescribed cod liver oil and estimated to have received an average daily intake of approximately 650 U.S.P. units of supplementary vitamin D (row 9) than on infants prescribed irradiated evaporated milk affording around 125 U.S.P. units of vitamin D per day (row 10).

2. On the whole, the average stature of infants prescribed daily vitamin D supplements assaying over 1500 U.S.P. units is *not appreciably different* from the average for infants prescribed between 250 and 850 U.S.P. units. Referred to the averages from Jeans and Stearns (row 1) and from Peatman and Higgons (row 4) for male infants given upwards of 1500 U.S.P. units of vitamin D daily, the averages of row 2 on Stearns, Jeans and Vandecar's subjects imbibing "the equivalent of one teaspoonful of cod liver oil" are identical with the latter at nine months and, at six months, 0.3 cm. below the latter and above the former. For infants of both sexes, the averages from Slyker, Hamil, Poole, Cooley and Macy on infants prescribed a daily intake of 250 to 810 U.S.P. units (row 9) are practically equivalent at age six months to the high dosage group of Jeans and Stearns (row 7), and at nine months to that of Peatman and Higgons (row 8). One exception to the general similarity in stature from moderate and high vitamin D dosage is found in the study by Rhoads, Rapoport, Kennedy and Stokes. Their averages for the group prescribed three teaspoonfuls of cod liver oil daily are the lowest averages shown at ages nine months and one year, while at six months the only average ex-

ceeded is that from Slyker, Hamil, Poole, Cooley and Macy for infants receiving no vitamin D supplement. It is plausible that the low values obtained by Rhoads, Rapoport, Kennedy and Stokes reflect the operation of selective factors in making up the sample. Possibilities are: a) Infants not enrolled in the study until the third month and not previously receiving any vitamin D supplement may have been assigned to the high dosage group. b) There may have been a systematic tendency to place the smaller appearing infants on the higher dosage. c) Infants of Italian ancestry (these constituted 25 per cent of the total number of subjects studied) may have fallen into the high dosage group with unusually disproportionate frequency.

3. Compared with the composite averages at ages six months and one year for White infants studied in the period 1926-41 (see p. 14), the averages on both sexes are higher for daily intakes of vitamin D ranging from 250 to 9000 U.S.P. units and lower for those ranging from 0 to 152 U.S.P. units. Correspondingly, compared with the composite averages covering the latter half of the first year on White males of the middle and upper classes measured over the years 1926-41, (see p. 44), the averages are smaller from male infants in the vitamin D dosage level 60 to 135 U.S.P. units and (except for the Rhoads, Rapoport, Kennedy and Stokes' values) larger from those at the dosage levels 340 to 9000 U.S.P. units.

Turning from size to gain, stature increments for varying age intervals and vitamin D dosages may be reproduced or derived from all eight of the investigations initially listed. Robinson (1941) studied gain in stature during a six-month period under "different types of vitamin D administration." The subjects were 208 "normal, healthy infants"—50 per cent of each sex, 88 per cent White and 12 per cent Negro. Beginning "before the tenth day of life," 79 of the subjects were prescribed five drops of viosterol ("800-1000 U.S.P. units of vitamin D") daily, while the other 129 received irradiated milk affording 100-150 U.S.P. units of vitamin D daily. Of the former group, slightly less than one-half were breast-fed for a minimum of three months and the remainder given evaporated cow's milk. Of the latter group, around 80 per cent were fed evaporated milk and the other 20 per cent whole milk. The milks and viosterol were supplied to the parents. All infants were started on orange juice by six weeks, with cereal being added "when the child weighed 12 to 13 pounds."

The average gain in stature for the "800-1000 U.S.P. units" group was 13.5 cm. For the group on a supplementary intake of 100-150 U.S.P. units daily, the average gain (15.4 cm.) was higher by 1.9 cm. Unfortunately, the six-month age interval represented by these gains was not specifically designated. It may have extended from birth; from "before the tenth day of life"; from "the first visit to the clinic when between 5 and 6 weeks of age"; or, from varying ages in the early part of the first year.

Mean gain in stature between the third and seventh postnatal months was reported by Rapoport and Stokes (1936) on 14 White infants receiving 100-150 U.S.P. units of vitamin D daily in the form of irradiated milk. Eight of the infants were fed evaporated milk, diluted 50 per cent with water, and the remaining six whole fluid milk, undiluted. Five per cent dark corn syrup was added to both types of formula. Alternate infants received orange juice or cevitamic acid, both being supplemented with 2 per cent ferric ammonium citrate. At the beginning of the experimental period the subjects gave a mean age of 2.1 months. They were studied for 4.5 months and showed a mean gain in stature of 11.3 cm. In comparison, the stature trend drawn to the composite averages for White infants measured in the period 1926-41 (see p. 14) registers a rise from 2.1 months to 6.6 months of 10.1 cm., or over a centimeter less.

Eliot, Nelson, Barnes, Browne and Jenss (1936) obtained average increase in stature per month on infants between the age limits of one week and nine months assigned to three vitamin D groups. The subjects were 567 full-term infants, 59 per cent White and 41 per cent Negro. They lived "in their own homes" and were supplied either cod liver oil, viosterol, or one of four forms of evaporated vitamin D milk. In U.S.P. units, the daily dosage levels were 135-400 for the 272 infants given vitamin D milks, 270-810 for the 163 infants given cod liver oil, and 675-2000 for the 132 infants given viosterol. The experimental periods all fell between September and May, though they varied in duration for different subjects from two months to eight months. Specific for span of observation, the "average monthly gain in length" of each infant was determined. These values gave mean stature increments of 2.47 cm. per month on the cod liver oil series, 2.44 cm. on the series receiving vitamin D milks, and 2.36 cm. on the viosterol series.

The gain in stature between three and six months of four infants "living under carefully controlled conditions of housing and diet," and given high dosages of vitamin D, was studied by Jeans and Stearns (1938). Beginning the first postnatal month, one infant of each sex received viosterol in oil ("allowing around 4,500 U. S. P. units of vitamin D daily"), a second male infant was given 3 cc. of cod liver oil concentrate emulsified in cream and dispersed in milk ("2,200 units of vitamin D"), and a second female infant three teaspoonfuls of cod liver oil ("1,800 units of vitamin D"). The average gain for the two males is shown in row 1 of the succeeding tabulation, that for all four infants in row 7.

The extent to which average stature at six months exceeds average stature at three months may be derived from the Stearns, Jeans and Vandecar (1936) figures for two vitamin D levels shown in the preceding tabulation. The resulting values represent approximately 20 male infants receiving 340-400 U.S.P. units of vitamin D daily from the first month, and four male infants followed continuously from the first month and fed 60-135 U.S.P. units of vitamin D in the form of irradiated milk. They are given in rows 2 and 3 of the tabulation to follow.

Increases in average stature over successive age intervals between three months and two years are available from Peatman and Higgons (1938). With these infants, vitamin D supplement in the form of cod liver oil was started at four weeks. By two months the minimum daily prescription was 1600 U.S.P. units, and by four months it was double this amount. From eight months on, the recommended dosage fell within the limits of 3200 U.S.P. units and three times this quantity. Rows 4 and 8 of the succeeding tabulation afford four increment values each, the former being derived from stature means on the male subjects and the latter from means for both sexes.

From study of two series of White male infants—42 prescribed and supplied approximately 1500 U.S.P. units of vitamin D daily in the form of three teaspoonfuls of cod liver oil, and 48 prescribed and supplied around 110 U.S.P. units in the form of irradiated evaporated milk—Rhoads, Rapoport, Kennedy and Stokes (1941) secured stature data covering consecutive age periods "from an average initial age of 6 weeks until the age of 2 years." The subjects were drawn largely from "the lower income groups" and roughly 40 per cent were of southeast European ancestry. They yielded the average increment values shown in rows 5 and 6 of the tabulation below.

The last three rows of the tabulation—rows 9, 10 and 11—were derived from the averages for stature obtained by Slyker, Hamil, Poole, Cooley and Macy (1937). Their subjects were infants of the "indigent or near-indigent class" supervised from around two months of age "to the end of their first year." Some were prescribed cod liver oil in a dosage to afford 250-810 U.S.P. units of vitamin D daily, others received irradiated evaporated milk affording a daily intake of 95-152 U.S.P. units, and still others were given no supplementary vitamin D prior to eight months of age.

GAINS IN STATURE (cm.) FOR INFANTS GIVEN DIFFERENT DOSAGES OF VITAMIN D

		Age interval (mos.):							
	Daily Dosage (U.S.P. units)	3 to 6 Cases	3 to 6 Av.	6 to 12 Cases	6 to 12 Av.	12 to 24 Cases	12 to 24 Av.	3 to 24 Cases	3 to 24 Av.
	WHITE MALES								
	Controlled intake studies								
1.	2200-4600	2	7.1						
2.	340-400	21	8.0						
3.	60-135	4	7.8						
	Prescribed intake studies: Middle and upper classes								
4.	1600-9000	156	7.1	144	8.1	101	11.4	101	26.6
	Prescribed intake studies: Lower classes								
5.	1500	42	7.0	42	8.2	42	11.7	42	26.9
6.	110	48	6.6	48	7.9	48	11.2	48	25.7
	BOTH SEXES								
	Controlled intake: White infants								
7.	1800-4600	4	7.2						
	Prescribed intake: White infants, middle and upper classes								
8.	1600-9000	303	6.6	296	8.0	209	11.8	209	26.4
	Prescribed intake: White and Negro infants, lower classes								
9.	250-810	c.250	6.6	c.180	9.1				
10.	95-152	c.70	6.4	c.45	8.3				
11.	None	c.50	5.5						

Findings which accrue from this tabulation and from the additional studies reviewed are:

1. On the whole, the different samples of infants prescribed daily vitamin D supplements assaying upwards of 1500 U.S.P. units yield gains in stature that are of similar magnitude. Over the age

interval from three to six months, the gains on males are 7.0 cm. from Rhoads, Rapoport, Kennedy and Stokes (row 5) and 7.1 cm. from Jeans and Stearns (row 1) and from Peatman and Higgons (row 4). The male gains from Peatman and Higgons and from Rhoads, Rapoport, Kennedy and Stokes agree within 0.1 cm. for the interval six months to one year, and within 0.3 cm. for the intervals one to two years and three months to two years. Passing to the materials for both sexes, the gains from three to six months are 7.2 cm. from Jeans and Stearns (row 7) and 6.6 cm. from Peatman and Higgons (row 8). The infants studied by Eliot, Nelson, Barnes, Browne and Jenss and prescribed 675-2000 U.S.P. units of vitamin D appear to manifest an average figure in the neighborhood of that for Jeans and Stearns, while those studied by Robinson and prescribed 800-1000 U.S.P. units daily apparently made an average gain approximating that for Peatman and Higgons.

2. The average values for gain in stature on infants prescribed less than 150 U.S.P. units of supplementary vitamin D per day are in some instances larger and in some instances smaller than those for infants prescribed upwards of 1500 U.S.P. units. From Rhoads, Rapoport, Kennedy and Stokes, the 48 White males given 110 U.S.P. units daily (row 6) show lower increases over all age periods between three months and two years than do the 42 White males prescribed 1500 U.S.P. units per day (row 5). The same finding was obtained by Rhoads, Rapoport, Kennedy and Stokes on 63 Negro males, 32 of whom received the 110 unit dosage and 31 the 1500 unit dosage (see Part II). For infants of both sexes, and for the age period from three to six months, the gain from Slyker, Hamil, Poole, Cooley and Macy on about 70 infants prescribed a daily intake of 95-152 U.S.P. units of vitamin D (row 10) is lower than the gain from Jeans and Stearns for four infants given 1800-4600 U.S.P. units daily (row 7). In contrast, the increase between three and six months on the four male infants from Stearns, Jeans and Vandecar fed 60-135 U.S.P. units daily (row 3) is higher than that on the two male infants from Jeans and Stearns given 2200-4600 U.S.P. units (row 1). Similarly, the gain for the 14 infants studied by Rapoport and Stokes and given 100-150 U.S.P. units of vitamin D daily is seemingly greater between three and six months than the gains from Jeans and Stearns and from Peatman and Higgons representing daily dosage levels above 1500 U.S.P. units.

3. More information is especially needed at vitamin D dosage levels between 250 and 1000 U.S.P. units daily. The gain in average stature over the period from three to six months is high for the male infants of Stearns, Jeans and Vandecar given 340-400 units (row 2), but not high for the infants of both sexes prescribed a similar dosage (250-810 units) by Slyker, Hamil, Poole, Cooley and Macy (row 9).[8] The latter, however, show a high increase in average stature for the interval six months to one year. Robinson reports appreciably *smaller* gains in stature during the early part of the first year on infants prescribed 800-1000 U.S.P. units of vitamin D than on infants given 100-150 units. Eliot, Nelson, Barnes, Browne and Jenss find *no difference* in stature gain over the first nine months between infants prescribed 270-810 U.S.P. units of vitamin D and infants receiving 135-400 units. Stearns, Jeans and Vandecar obtained a slightly *greater* average gain during the early part of the first year from 21 male infants given 340-400 U.S.P. units of vitamin D daily (row 2) than from four infants given 60-135 units (row 3)—over the age interval from seven to sixteen weeks individual gains varied from 6.1 cm. to 7.4 cm. on the higher dosage and from 3.5 cm. to 6.8 cm. on the lower. The findings of Slyker, Hamil, Poole, Cooley and Macy for the entire first year—comparing infants prescribed 250-810 U.S.P. units of vitamin D (row 9) with infants receiving 95-152 U.S.P. units (row 10)—are in general agreement with those of Stearns, Jeans and Vandecar and represent larger samples.

4. Over age intervals extending through the second postnatal year (*e.g.*, the periods from one to two years and from three months to two years) gains in stature are available from two studies for vitamin D levels above 1500 U.S.P. units and from one study for dosages below 150 U.S.P. units. The increase in average stature between three months and two years for the White male infants of the lower classes prescribed 1500 U.S.P. units of vitamin D daily by Rhoads, Rapoport, Kennedy and Stokes (row 5) is *identical* with that from the composite averages for White males of the middle and upper classes measured 1926-41 (see p. 44). A similar finding holds from the study of Peatman and Higgons on infants of the middle and upper classes prescribed 1600-9000 U.S.P. units (row 4). Referred to the same composite increment, the value

---

[8] In this connection, reference should be made to the tabulation on p. 50.

from Rhoads, Rapoport, Kennedy and Stokes on White males of the lower classes receiving 110 U.S.P. units of vitamin D daily (row 6) is *smaller* by 1.2 cm.

Supplements of the Vitamin B complex, thiamine, and minerals

Elias and Turner (1936), Poole, Hamil, Cooley and Macy (1937, 1938), and Rhoads, Rapoport, Kennedy and Stokes (1941) each studied absolute stature at successive ages for infants fed supplementary amounts of thiamine or the vitamin B complex from the first or second month of postnatal life. The sample employed by Elias and Turner consisted of 121 White infants receiving "presumably large quantities of the vitamin B complex in the form of wheat germ and brewer's yeast." It was drawn from infants residing in a poverty-stricken district and enrolled in a clinic for well babies. While some of the infants were not followed for more than four months, approximately one-third were studied throughout their first year. The diet prescribed included "whole milk and water" with added dextrimaltose, orange juice, cod liver oil from October to May, cereal beginning the fourth month, pureed vegetables, egg yolk and banana in the sixth month, stewed fruit and scraped beef after seven months. The wheat germ and brewer's yeast were added to the dextrimaltose and to the cereal.

Poole, Hamil, Cooley and Macy published averages for stature during the first year on infants receiving early additions to the diet of a) "vitamin B_1, in the form of a water extract of rice polishings," and b) "vegetable soup reinforced with wheat germ." The subjects were 224 infants of the "indigent and near-indigent class" living in their own homes. Approximately two-thirds were White and one-third Negro. For the most part they were under dietary supervision from the first or second month to one year of age, their mothers being advised on feeding management and other aspects of health care both at a clinic and by visiting nurses. The diet was composed of "evaporated milk, water, and corn syrup acidified by the addition of commercially dehydrated lemon juice powder," cod liver oil, cereal beginning the fifth month, strained vegetables by six months, and strained fruits by seven months. Sixty-six infants were given "formula . . . to which at the time of manufacture had been added vitamin B (B_1) in the form of a water-soluble extract of rice polishings.'' The other 138 infants received vegetable soup enriched with wheat germ, the amount being gradually increased to eight teaspoonfuls daily by two months of age.

Averages for stature at selected ages in both the first and second postnatal years were obtained by Rhoads, Rapoport, Kennedy and Stokes on 20 White males and 19 Negro males given ''0.5 tablespoonful of brewer's yeast powder daily . . . from an average initial age of 6 weeks until the age of 2 years.'' As with the investigations of Elias and Turner and of Poole, Hamil, Cooley and Macy, the infants were of the ''lower income groups'' and lived in their own homes. They were prescribed irradiated evaporated milk, orange or tomato juice, ten drops of carotene daily, banana and cereal beginning the fourth month, pureed vegetables and fruits by six months, potatoes and meat by ten months. The ''milk and the vitamin supplements were delivered at the homes every two weeks by the nurse and by the social worker.''

In the tabulation which follows averages for stature from each of the above studies are presented and aligned with two series of composite averages (those for White infants of the middle and upper classes measured 1926-41 and those for White infants of all socio-economic levels studied 1926-41).

AVERAGE STATURE (cm.) OF INFANTS GIVEN SPECIAL SUPPLEMENTS OF VITAMIN B COMPLEX OR OF B_1

PRESCRIBED INTAKE STUDIES: LOWER CLASSES

	Source of B complex or B_1	Approx. Number	Age (mos.): 3	6	9	12	24
	BOTH SEXES						
Elias and Turner (1936)	Wheat germ and yeast	50	60.6	66.5	71.0	75.5	
Poole and others (1937)	Ext. rice polishings	60	60.0	66.5	71.0	75.2	
Poole and others (1938)	Wheat germ	120	59.8	67.5	71.8	76.0	
1926-41 Composite (middle and upper classes, see p. 44)		1100	60.5	67.0	71.6	75.4	
1926-41 Composite (all classes, see p. 14)		1900	60.2	66.7	71.4	75.3*	

PRESCRIBED INTAKE STUDIES: LOWER CLASSES

	Source of B complex or B_1	Approx. Number	Age (mos.):				
			3	6	9	12	24
		MALES					
Rhoads and others (1941):							
White	Brewers' yeast	20	59.5	66.5	71.1	75.1	86.7
Negro		19	58.6	65.7	70.6	74.8	86.2
1926-41 Composite (middle and upper classes, see p. 44)		550	61.2	67.9	72.5	76.4	88.1

---

*The reader is reminded that at one year of age the composite sample for all socio-economic groups is fairly heavily weighted with infants drawn from the middle and upper classes (see p. 14).

Obviously, there is no consistent tendency for the averages on infants given special supplements of thiamine or vitamin B complex from early infancy to be higher than the composite averages on infants largely unselected for adequacy of diet. Only at ages six months and one year, for both sexes combined, do the composite means from the three groups given B and B_1 supplements exceed the composite means for White infants of all socio-economic levels studied 1926-41. At six months the difference is 0.3 cm. and at one year 0.4 cm. In neither instance does the estimated significance ratio exceed the requisite value for rejection of the null hypothesis at the 5 per cent level of confidence. It is of interest that Poole, Hamil, Cooley and Macy interpreted the apparent failure of these dietary additions to "significantly influence" average stature as probably indicative of the adequacy of the diets without the additions.

Blatt and Schapiro (1935) investigated the influence on stature from making a cereal mixture especially enriched in mineral content a component of the infant's diet beginning at three months of age. The subjects were 70 well infants ranging in age from three to thirty months and "observed for periods varying from 6 weeks to 1 year." Their dietary while under observation consisted of whole milk with dextrimaltose, orange juice and cod liver oil, the enriched cereal mixture after three months, vegetables and soups by five months, eggs and puddings by nine months, fruits, bacon and toast by one year.

AVERAGE STATURE (cm.) OF INFANTS FED AN ENRICHED CEREAL OVER VARYING PERIODS

	6 mos.	12 mos.	18 mos.	24 mos.
Blatt and Schapiro (1935)	64.7	71.6	76.3	83.7
1926-41 Composite (p. 14)	66.7	75.3	81.5	87.0

Compared with the averages for stature representing the entire series of physically normal White infants studied in North America over the years 1926-41, the Blatt and Schapiro values are seen to be lower by 3.7 cm. at one year, 5.2 cm. at eighteen months, and 3.3 cm. at two years. Still stronger proof that the results are exceptional and not readily interpreted follows from location of the comparative rank of this study in Tables VIa, VIIIa and IXa of the appendix, and from noting that the subjects were claimed to be "children in good health, living under as nearly ideal conditions as institutional life permitted."

The relationship between *gain in stature* and supplementation of the infant's diet with vitamin B_1, the vitamin B complex, and/or minerals, has been investigated by Blatt, Harris, Jacobs and Zeldes (1941), Blatt, Jacobs, Murphy and Zeldes (1941), Haas (1931), Hoobler (1931) and Joslin and Helms (1937). Hoobler collected stature data on approximately 125 infants " in the nursery wards of the Florence Crittenden Hospital, Detroit." Some of the subjects were breast-fed, others were fed "whole milk dilutions" with added dextrimaltose, and still others received diluted whole milk and dextrimaltose with additions of the vitamin B complex "in the form of the extract of wheat germ and the extract of brewers' yeast." Over "a twenty-eight day period," the average gains in stature were 2.5 cm. for the breast-fed group, 2.3 cm. for the group fed diluted cow's milk plus "the maltose and dextrin preparation with vitamin B additions," and 2.1 cm. for the group given diluted cow's milk plus "the maltose and dextrin preparation only."

Joslin and Helms studied 100 infants through a pediatric clinic "over a period of one year." The infants were prescribed a diet "consisting of milk, water and carbohydrate, varied only as their ages demanded, with the addition of cereal and vegetables after six months of age." Half of the group was given a carbohydrate mixture with the vitamin B complex added, while the other half received "carbohydrate without additional vitamin B." The average stature gain of the former was reported to be 6.3 cm. more than that of the latter. Twenty orphanage infants also were followed by Joslin and Helms "for two months." Ten were fed a cereal mixture rich in the vitamin B complex (Cerevim) and the other 10 were given nonreinforced cereals. The former group showed an average gain in stature 1.3 cm. greater than that for the latter. However, the latter (control series) was 5.7 cm. taller than the Cerevim group at the beginning of the experiment.

The influence on gain in stature from fortifying the infant's diet with a cereal enriched in minerals and vitamin B_1 was investigated by Blatt, Harris, Jacobs and Zeldes. Quantitative results were reported on 10 infants followed from the first to the third postnatal months. Over this period the simplicity of the diet (milk, dextrimaltose, orange juice and cod liver oil) was considered relatively ideal for registering "the overall effect of supplementing the diet with elements such as calcium, phosphorus, iron and Vitamin B_1." The enriched cereal (New 5-Minute Cream of Wheat) was added to the daily formula, being gradually increased in amount from one teaspoonful to three or four tablespoonfuls. The infants were under continuously controlled observation from their first month for an experimental period of eight weeks. Their average gain in stature was 5.5 cm. While this figure was reported as higher by 1.0 cm. than that from a control series of 13 infants, it appears not to exceed a fairly low gain when compared with findings from other studies. For White infants of the middle and upper socio-economic levels measured 1926-41 (see p. 44), the composite average at age three months is 6.2 cm. higher than the composite average for age one month.

Average gains in stature are available from Blatt, Jacobs, Murphy and Zeldes on five groups of infants receiving diets supplemented with homogenized vegetables. The subjects were between one and six months of age at the beginning of the experiment and were studied under controlled conditions for four months. All received the "same basic milk formula, cod liver oil and orange juice." The homogenized vegetable mixture—affording "54 mg. of phosphorus, 1.58 mg. of iron, and 0.15 mg. of copper per 100 grams"—was added to the formula of four infants aged one to two months and nine infants aged two to three months. It was fed by spoon to four infants each beginning the fourth and fifth months and to two infants beginning the sixth. The daily intake of the mixture was gradually increased from one or two teaspoonfuls to three or four tablespoonfuls. In the tabulation which follows the average stature increment of each group is listed and brought into alignment with the corresponding increments from the composite trend for White infants examined over the years 1926-41 (see p. 14).

STATURE GAINS (cm.) OF INFANTS FED HOMOGENIZED VEGETABLES AND OF CONTROL GROUPS

Month Vegetables Added to Diet	Experimental Period (mos.)	Number	Average Increase	Average Increase, 1926-41 Composite
Second	4	4	11.0	11.3
Third	4	9	10.7	9.9
Fourth	4	4	8.9	8.8
Fifth	4	4	7.8	7.9
Sixth	4	2	6.0	7.2

It is evident that the study yields no marked or consistent indication of an association between the early addition of vegetables to the infant's diet and rate of gain in stature.

A study by Haas dealt with the relationship between rate of growth in stature and the use of powdered ripe banana in place of other carbohydrate. The subjects were 75 infants all similarly fed except that 41 "received banana powder . . . in their formula," while the remaining 34 "received some form of carbohydrate other than banana." The duration of the experimental period may have varied with different infants from less than one month to upwards of three months. At ages around 1.5 months and 4.0 months the average gain in stature per month for infants fed ripe banana powder (the equivalent of whole ripe bananas minus water) approximated 0.9 cm. more than the gains of the control series. At ages above six months the gains for the experimental and control groups were practically identical. The lack of difference here was considered "probably due to the fact that by this time general foods were in the diet of the controls."

Summary

The foregoing examination of materials on "Stature in relation to diet" was introduced with a number of leading questions. It is now pertinent to reiterate these questions and characterize the findings on them. Do infants breast-fed during the early postnatal months tend to be taller than infants artificially fed? There is a substantial amount of research indicating that otherwise comparable groups of infants—whether fed from their first month on human milk or on carefully prepared formulas of pasteurized or evaporated cow's milk—are equally tall at three and six months of age. Do infants given one to three teaspoonfuls of cod liver oil daily show greater stature growth than infants receiving one-half teaspoonful of cod liver oil or 50-150 U.S.P. unit irradiated milk? There is reasonably adequate research evidence to support the generalization that infants given less than 150 U.S.P. units of supplementary vitamin D daily from the first postnatal month tend to become slightly shorter in average stature than infants receiving larger supplements. Is there a positive relationship between rate of growth in stature and early inclusion in the dietary of supplementary minerals and/or the vitamin B complex? The relevant studies, though several in number, do not justify the inference that rate of growth in stature is any different for infants fed from early ages on diets especially reinforced with thiamine, the vitamin B complex, or minerals, than for infants not given such additions but fed egg yolk, vegetables, fruits, and whole grain cereals at the customary ages.

Prescribed and supervised dietaries

For additional findings relating to prescribed and supervised dietaries the reader is referred to the materials synthesized in the section on socio-economic differences under the caption "Stature of socio-economic groups in relation to systematic health guidance," see pp. 34-38).

S.C.E.R.T., West Bengal
Library
Calcutta
25/3, B. C. Road

PART II

ANNOTATED BIBLIOGRAPHY ON INFANT STATURE COVERING STUDIES MADE IN NORTH AMERICA PRIOR TO 1942

Adair, Fred L. and **Scammon**, Richard E. **1921** A study of the ossification centers of the wrist, knee, and ankle at birth, with particular reference to the physical development and maturity of the newborn. *Amer. J. Obstet. and Gynecol.*, 2, 35-60.

Measurements of stature ("total length") were obtained "within 48 hours after birth" on 100 neonates born at the Swedish Hospital, Minneapolis. Mothers: "all patients of the better class" living in Minneapolis and St. Paul, Minnesota. Their range in pregnancy period (first day of last menstruation to parturition) was from 233 to 312 days. Infants: "taken seriatim from the service of the senior author." Fifty-five per cent were males, 64 per cent first-born. Variation in birth weight was from 2080 gm. to 5060 gm.

STATURE (cm.) OF "TWIN CITY" NEW-BORNS OF UPPER CLASSES

Males			Females		
Number	Mean	Range	Number	Mean	Range
55	50.5	42-55	45	50.0	43-54

Bakwin, Harry and **Bakwin**, Ruth Morris. **1931** Body build in infants: II. The proportions of the external dimensions of the healthy infant during the first year of life. III. Body build in disease. *J. Clin. Invest.*, 10, 377-403.

Stature means for two groups of "healthy" infants and three groups of "sick" infants were compared. Subjects: All "under 1 year of age," American-born, residents of New York City, of "Caucasian antecedants". "Healthy" was defined as neither "suffering from acute or chronic illness" nor "strikingly underweight" (p. 377). One healthy group consisted of 475 infants, most of whom were "observed repeatedly in a special clinic" at Fifth Avenue Hospital. This group was "partially or completely breast-fed from 3 to 6 months," and given "cod liver oil and orange juice after the age of 3 weeks, egg yolk and vegetable or cereal by the fourth month'' (p. 378). Its ancestry was northwest European for half the cases, with 25 per cent each coming from southern Europe and from northeast or central Europe. The income of the parents was ''between $30 and $35 per week (in 1929)''.

The other healthy group numbered 119 infants ''admitted to the wards of Bellevue Hospital . . . because of illness of the mothers'' (p. 382). Many were ''artificially fed from early life,'' and before admission to the hospital received little or no cod liver oil and inadequate ''energy-yielding foods . . . and amounts of orange juice'' (p. 382). The parents were ''mainly of Irish descent,'' with incomes ''between $15 and $22 per week (in 1929)''.

The sick groups were infants with eczema, tetany, and acute intestinal intoxication. All were examined at Bellevue Hospital. In the groups were ''typical facial eczema'' and with tetany (''serum calcium concentration was below 8.0 mgm. per cent'') there were 59 and 45 infants, respectively. In the group with acute intestinal intoxication (''characterized by somnolence alternating with periods of hyper-irritability and at times convulsions, cyanosis, hyperpnea, oliguria or anuria . . . evidence of dehydration . . . fever and an associated infection . . . diarrhea and vomiting'') there were 133 infants, 78 of whom failed to survive.

The following tabulation gives the means at selected ages for three of the five groups. For each of these samples the numbers of males and females were about equal. Means for the two smaller samples are reproduced in the section of Part I treating ''Relationships between stature and disease'' (pp. 78, 89).

STATURE (cm.) OF NEW YORK INFANTS OF THREE SOCIO-DIETARY AND DISEASE GROUPS

Age Group Midpoint	Range (wks.)	Special clinic: moderate income N	Mean	"Well": low income N	Mean	Acute intestinal intoxication N	Mean
2	0 thru 3	---	51.3	31	51.6	12	50.7
14	12 thru 15	---	59.9	9	59.4	20	56.3
26	24 thru 27	---	67.5	6	62.8	8	62.1
38	36 thru 39	---	71.6	5	69.3	5	65.6
50	48 thru 51	---	74.7	6	70.2	2	67.3

It was found that after the first month the infants from ''very poor families'' and on ''probably inadequate'' diets were ''shorter in stature'' than those from ''families of moderate income'' and on ''diets adequate in the known essential food substances'' (p.

393). "Infants with acute intestinal intoxication were, on the average, shorter than the healthy" groups, as were the infants with tetany. Infants with eczema tended to be longer than the "well" Bellevue sample but shorter than the Fifth Avenue sample.

Bakwin, Harry and **Bakwin**, Ruth Morris. **1934** Body build in infants: V. Anthropometry in the new-born. *Hum. Biol.*, 6, 612-626. (See also, Bakwin, Harry and Bakwin, Ruth Morris. 1934 External dimensions of the newborn. *Amer. J. Dis. Child.*, 48, 1234-1236).

Stature at birth in relation to sex, birth order, season of birth, nationality of parents, and socio-economic environment was investigated. Sex and birth order differences were studied on 1653 White infants born at the Bellevue Hospital, Fifth Avenue Hospital, New York Nursery and Child's Hospital, and New York Infirmary for Women and children. All measurements made by one anthropometrist, Miss Allene Jones.

STATURE (cm.) OF NEW YORK CITY NEW-BORNS "BY SEX AND ORDER OF BIRTH"

	Males				Females			
	N	Mean	S.D.	V	N	Mean	S.D.	V
First-born	395	50.4	1.96	3.9	417	49.7	1.88	3.8
Later-born	423	50.8	2.02	4.0	418	50.2	1.97	3.9

Mean stature was "larger in males than in females and in later born than in first born infants" (p. 612). For both sexes combined, the difference in stature between first- and later-born infants was found to be statistically significant at the 1 per cent level of confidence. It is apparent that the finding of male stature exceeding female stature is no less dependable.

The influence of socio-economic status was considered using 675 male infants born at the Bellevue and Fifth Avenue hospitals. Infants born at the Fifth Avenue Hospital were "for the most part, from homes of moderate income": Infants born at the Bellevue Hospital were "almost exclusively from very poor homes" (p. 616).

STATURE (cm.) OF MALE NEW-BORNS BY "SOCIAL ENVIRONMENT" AND BIRTH ORDER

Group	First-born				Later-born			
	N	Mean	S.D.	V	N	Mean	S.D.	V
Moderate income	114	50.9	1.77	3.5	91	51.5	2.09	4.1
Poverty-stricken	205	50.0	2.10	4.2	265	50.7	2.06	4.0

For each birth order classification, stature was significantly lower (at the 1 per cent confidence level) for male neonates born at the Bellevue Hospital than for those born at the Fifth Avenue Hospital.

The relationship between season of birth and stature was studied on 1217 cases, that between nationality of parents and stature on 604 cases. The sexes were not separated in either analysis.

STATURE (cm.) OF NEW YORK CITY NEW-BORNS BY BIRTH SEASON AND PARENTAL STOCK

Season of Year	N	Mean	Ethnic Group	N	Mean
May-July	238	49.8	North European	234	50.0
August-October	572	49.7	Jewish	73	49.8
November-January	213	49.5	Central European	103	49.7
February-April	194	49.2	Mediterranean	194	49.5

It was stated that "no significant differences" were found among the means of the seasonal or ethnic subgroups.

Bakwin, Harry and **Bakwin,** Ruth Morris. **1936** Growth of thirty-two external dimensions during the first year of life. *J. Pediat.*, 8, 177-183.

Central tendency and variability figures were reported for White infants representing eight ages during the first postnatal year. Data: Obtained from 1328 examinations made on 94 males and 104 females born at the Fifth Avenue Hospital, New York City, and "supervised from birth in a special clinic" for well infants. Subjects: Mainly of North European, Mediterranean, and Jewish lineage; "from homes of moderate income" (p. 177).

STATURE (cm.) OF NEW YORK CITY, MIDDLE CLASS, CLINIC SUPERVISED INFANTS

Age Group		Males		Females	
Midpoint	Range (wks.)	Mean	S.D.	Mean	S.D.
2	0 thru 3	51.9	2.23	51.0	1.95
12	8 thru 15	60.1	2.72	58.9	2.31
28	24 thru 31	68.5	2.25	67.4	2.00
40	36 thru 43	73.2	2.67	71.6	2.23
52	48 thru 55	76.6	2.27	74.8	2.21

It is not clear to what extent this sample was independent of that employed by Bakwin, Bakwin and Milgram (1934). The total number of cases was 71 less than in the earlier (1934) paper. The findings differed mainly in that the 1936 paper carried consistently lower standard deviations for males.

Bakwin, Harry and **Bakwin,** Ruth Morris **1939** Body build in infants: IX. Body build in eczema. *Hum. Biol.,* 11, 269-276.

An extension of the authors' 1931 comparison of infants with eczema and ''healthy'' infants, using a larger series of both eczematous and control cases. Subjects: 905 New York City infants; ''nationalities . . . mixed . . . white''; drawn from a ''low income'' area. Experimental series: 90 males and 40 females ''with typical facial eczema . . . obtained from the wards or Out Patient Department of Bellevue Hospital'' (p. 270). Control series: 433 males and 342 females ''admitted to Bellevue Hospital as healthy boarders or because of mild upper respiratory infections . . . received no regular medical supervision before admission'' (p. 270). Procedure: Following construction of curves from the control series for central tendency and for plus and minus one standard deviation, the eczematous series was referred to these curves and classified as falling more than one standard deviation above the mean, between one standard deviation and the mean, between the mean and one standard deviation lower, and more than one standard deviation below the mean.

STATURE OF INFANTS WITH ECZEMA RELATED TO VARIABILITY ZONES FOR A CONTROL SERIES

	−3 S.D.'s to −1 S.D.	−1 S.D. to Mean	Mean to +1 S.D.	+1 S.D. to +3 S.D.'s
Males	11	25	42	12
Females	5	9	20	6
Total	16	34	62	18

''Infants with eczema were, on the average, slightly but significantly taller than the control group'' (using chi-square method, for both sexes together P equalled .007). The authors noted that eczema was ''about twice as common in male as in female infants'' (p. 276).

Bakwin, Harry; **Bakwin,** Ruth Morris and **Milgram,** Lillian. **1934**
Body build in infants: IV. The influence of retarded growth. *Amer. J. Dis. Child.,* 48, 1030-1040.

Comparisons were made between a) infants of two socio-economic levels each under health clinic supervision, and b) infants from a "poverty-stricken district" part of whom were under "improved" care and part under non-improved care. Three samples were employed: Infants "from families with moderate incomes" enrolled in a "well baby clinic" at the Fifth Avenue Hospital, infants from "proverty-stricken homes" brought to a "well baby clinic" at the Bellevue Hospital, and infants of the Bellevue district not attending the clinic. The two Bellevue samples were not randomly selected "experimental" and "control" groups: All Bellevue mothers were solicited and urged to bring their infants to the clinic—the fact that some responded and others did not implies a systematic, and possibly important, sampling difference. At the Bellevue clinic, in addition to advice regarding diet and health care, cod liver oil was "distributed freely at the pharmacy" and some families were "aided with milk and occasionally with other foods" (p. 1031). The data on each sample covered the first postnatal year; in no instance, however was a constant number of subjects followed throughout the year.

STATURE (cm.) OF THREE GROUPS OF NEW YORK CITY INFANTS

Age Group Mid-point	Age Group Range (wks.)	Fifth Avenue Clinic N	Fifth Avenue Clinic Mean	Fifth Avenue Clinic S.D.	Bellevue Clinic N	Bellevue Clinic Mean	Bellevue Clinic S.D.	Bellevue Non-clinic N	Bellevue Non-clinic Mean	Bellevue Non-clinic S.D.
				Males						
2	0 thru 3	183	52.0	2.33	88	52.8	2.35	101	51.3	2.43
12	8 thru 15	117	59.8	3.25	93	60.0	2.76	78	58.3	3.41
28	24 thru 31	85	68.8	2.37	54	68.4	1.83	42	66.2	3.08
40	36 thru 43	60	73.1	2.84	36	72.0	3.11	36	70.8	3.37
52	48 thru 55	31	76.9	2.48	22	76.1	2.27	27	73.8	3.11
				Females						
2	0 thru 3	172	51.1	1.95	102	52.1	2.02	96	50.9	2.35
12	8 thru 15	101	59.0	2.31	57	58.7	2.75	52	56.9	3.11
28	24 thru 31	79	67.5	2.00	29	66.6	2.09	32	65.2	3.27
40	36 thru 43	55	71.6	2.23	25	70.4	2.41	26	69.5	3.83
52	48 thru 55	59	74.8	2.21	24	74.1	2.76	25	72.9	2.74

Considering both sexes and all ages jointly, the infants of the

Fifth Avenue clinic exceeded those of the Bellevue clinic by an average of 0.4 cm., while the latter exceeded the Bellevue unsupervised infants by an average of 1.5 cm. Specific for age, the Bellevue clinic means were highest at two weeks and the Fifth Avenue means highest from six to twelve months. The means for the Bellevue clinic and non-clinic cases failed to yield trends which diverged with advancing age: For females, the means of both Bellevue groups were higher at one year than at two weeks by exactly the same amount; for males, the difference between means was greater in the non-clinic sample from two to forty weeks and in the clinic sample from two to fifty-two weeks.

The authors concluded: "It has been possible, through care, particularly with respect to diet, to improve the growth in height" (p. 1039). In judging whether this conclusion was warranted one must confront both the finding of a consistent directional difference between the two Bellevue samples (the clinic means being larger than the non-clinic) and the finding of practically the same amount of difference (around 1.5 cm.) at two weeks of age as after various periods of differential treatment.

Baldwin, Bird T. **1921** The physical growth of children from birth to maturity. *Univ. Ia. Stud. Child Welf.*, 1, No. 1, Pp. 411.

Stature averages at selected ages from one month to two years were computed "from data of private cases furnished by Dr. Freeman" (pp. 248, 258-9). Subjects: New York infants, around 200 males and 150 females. No itemization was afforded of the number examined at each age.

STATURE (cm.) OF NEW YORK INFANTS EXAMINED IN PRIVATE PRACTICE

	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.
Males	54.9	62.3	67.4	73.4	77.1	82.7	87.8
Females	54.8	61.0	65.8	70.9	75.5	82.6	86.6

It is probable that this sample included many of the same records as analyzed by Freeman (1914) for both sexes together.

"Through the courtesy of the office of the Federal Children's Bureau," Baldwin also included in this reference (pp. 58-63) an advance report of the "Children's Year" findings on the stature of Iowa infants. These materials are not reviewed here, since they are abstracted as one sector of the more comprehensive analysis of "Children's Year" data by Woodbury (1921).

Baldwin, Bird T.; **Fillmore,** Eva A. and **Hadley,** Lora. **1930** Anthropometric measurements. [In] *Farm children: An investigation of rural child life in selected areas of Iowa.* New York: D. Appleton. Pp. 337 (192-201).

This study included an analysis of stature data on 205 infants living in a rural area. In accumulation of the data, careful attention was given to the maintenance of vigorous standards of anthropometric procedure. The subjects resided in rural communities of east-central Iowa.

STATURE (cm.) OF IOWA RURAL INFANTS

Age Group		Males			Females		
Midpoint	Range (mos.)	N	Mean	S.D.	N	Mean	S.D.
3	0 thru 5	18	62.3	4.6	15	58.4	3.3
9	6 thru 11	34	71.5	4.1	26	68.7	5.1
15	12 thru 17	39	76.7	3.3	20	76.1	3.9
21	18 thru 23	29	84.3	4.2	24	82.4	3.7

Bayer, Leona M. and **Davis,** Joseph H. **1940** Nondiabetic glycosuria in children: Report of nine cases. *Amer. J. Dis. Child.,* 60, 580-585.

Stature at age two years was reported for a single male infant diagnosed as having "nondiabetic glycosuria," or diabetes mellitus "with definite reservations" (p. 580). The subject was under observation in 1931 on the pediatric ward of Stanford University School of Medicine for "acute febrile illness." Examination showed "moderate glycosuria" and gave a stature of 90.9 cm.

Bayley, Nancy. **1940** *Studies in the development of young children.* Berkeley, California: Univ. Calif. Press. Pp. vii, 45.

A graph was presented showing the growth in stature of two infants over the age period from one month to two years. The subjects were drawn from among the group of 61 Berkeley infants previously reported upon by Bayley and Davis (1935). Their dietary and health histories were not discussed.

STATURE (cm.) OF TWO WHITE CALIFORNIAN INFANTS
MEASURED 1928-31

Subject	3 mos.	12 mos.	24 mos.
A	63.0	79.5	93.0
B	62.5	76.5	87.0

The two infants gave almost equivalent statures at three months, followed by progressive divergence in stature from this age to two years. The gain between three months and two years was 30.0 cm. for Subject A and 24.5 cm. for Subject B.

Bayley, Nancy and **Davis**, Frank C. **1935** Growth changes in bodily size and proportions during the first three years: A developmental study of sixty-one children by repeated measurements. *Biometrika.* 27, 26-87.

Findings derived from seriatim measurement of 61 infants were reported. Parents: White; "English-speaking"; residents of Berkeley, California; interested in bringing their infants for periodic examination to the Institute of Child Welfare, University of California. The mean educational level of the fathers was 13.8 years; of the mothers, 13.1 years. The mean annual income was $2844. Thirty per cent of the fathers were engaged in " professional or executive occupations." Subjects: Born at two Berkeley hospitals 1928-29, nearly all of northwest European or early American stock, reasonably healthy and well nourished. Stature was taken at ("or within a few days of") each month of age from one to twelve, fifteen and eighteen months, and two years. Measurements were made with the subjects "reclining during the first eighteen months, afterwards standing," (p. 30).

STATURE (cm.) OF BERKELEY INFANTS EXAMINED 1928-31

Both sexes

Age (mos.)	N	Mean	S.D.	V	Percentiles 25th	Percentiles 75th	Range
1	50	54.4	2.23	4.1	52.3	56.0	49.5-58.0
3	61	60.7	2.24	3.7	59.3	61.9	56.0-65.0
6	58	67.5	2.48	3.7	65.8	69.0	61.5-72.5
9	56	71.6	2.71	3.8	69.2	73.0	64.0-78.0
12	56	75.7	2.85	3.8	73.6	77.6	67.5-81.5
15	52	79.2	3.16	4.0	76.8	81.1	69.5-86.5
18	47	82.0	3.31	4.0	80.0	84.3	73.5-88.5
24	43	87.4	2.99	3.4	84.9	88.9	81.0-94.0

STATURE (cm.) OF BERKELEY INFANTS EXAMINED 1928-31–(Cont.)

Age	Males				Females			
(mos.)	N	Mean	S.D.	V	N	Mean	S.D.	V
1	24	55.5	2.31	4.2	26	53.4	2.41	4.5
3	31	61.7	1.68	2.7	30	59.7	2.24	3.8
6	30	68.5	2.16	3.2	28	66.4	2.13	3.2
9	27	72.9	2.28	3.1	29	70.3	2.51	3.6
12	28	76.9	2.53	3.3	28	74.5	2.63	3.5
15	27	80.6	2.85	3.5	25	77.7	2.76	3.6
18	23	83.2	3.34	4.0	24	80.9	2.85	3.5
24	24	88.4	3.28	3.7	19	86.1	2.02	2.4

Employing the medium of correlation (Pearson product-moment method), Bayley and Davis also studied the extent to which infants maintained their positions in the stature distribution from age to age. Stature at one month was found to correlate .87 with stature at three months, .77 with stature at six months, and .68 with stature at two years. Stature at three months with stature at six months and at two years gave coefficients of .84 and .71, respectively. The coefficients for stature at six months with stature at one and two years were .91 and .83, while stature at one year correlated .93 with that at two years.

Benedict, Francis G. and **Talbot,** Fritz B. **1915** *The physiology of the newborn infant: Character and amount of the katabolism.* Carnegie Institution of Washington, Publ. No. 233. Pp. 126.

Records for stature at birth, sex of subject, and parity of mother were presented on 99 White, nonpathological, full-term infants born at the Boston Lying-in Hospital. The data was collected during 1914-1915.

STATURE (cm.) OF BOSTON NEW-BORNS BY SEX AND PARITY

	Infants of Primiparae			Infants of Multiparae		
	Number	Mean	Range	Number	Mean	Range
Males	25	50.5	46.0-53.5	29	51.4	47.0-54.0
Females	13	49.5	46.5-54.0	32	50.4	46.5-54.5

For ~~this~~ each parity group, the mean stature of newborn males was greater than that of females. For each sex, the mean stature of infants of primiparous mothers was less than that for infants of multiparous mothers. Considering sex and parity jointly, newborn males of primiparae gave a mean similar to that for females of multiparae, while the mean for females of primiparae was 1.9 cm. less than that for males of multiparae.

Benedict, Francis G. and **Talbot,** Fritz B. **1921** *Metabolism and growth from birth to puberty.* Carnegie Institution of Washington, Publ. No. 302, Pp. vi, 213.

Records of stature for 150 "clinically normal American children" between the ages of two weeks and two years were reported. Material: Gathered 1915-17 at the Directory for Wet-Nurses, Boston Infants' Hospital. "Conditions here were especially favorable for the collection of normal data, as the children, mostly breast-fed, were the offspring of resident normal wet-nurses" (p. 25).

STATURE (cm.) OF BOSTON INFANTS

Age Group		Males		Females	
Midpoint	Range (mos.)	Number	Mean	Number	Mean
1	0.5 thru 1.5	8	55.1	6	53.5
3	2 thru 3	13	60.8	13	59.7
6	5 thru 6	12	67.3	12	64.0
9	8 thru 9	8	71.8	11	67.6
12	10 thru 13	6	75.7	9	72.3
18	16 thru 19	6	79.9	6	77.5
24	22 thru 25	4	83.4	4	83.4

Blackfan, Kenneth D. and **Yaglou,** Constantin P. **1933** The premature infant: A study of the effects of atmospheric conditions on growth and on development. *Amer. J. Dis. Child.,* 46, 1175-1236.

Figures were presented for monthly increment in stature derived from measurement of 96 premature infants, and for absolute stature utilizing 464 premature records. The data were collected 1926-29 at the Infants' Hospital, Boston. Subjects: "normal premature infants of a fetal age between 6 and 9 months . . . weighing from 1½ to 5 pounds . . . admitted to the hospital from a few hours to several weeks after birth," 74 per cent having been admitted within fifteen days. Care: Housed in especially designed air-conditioned nurseries, affording controlled temperature, humidity and ventilation. "Oil baths were given every other day . . .

until the infants reached a weight of 4 pounds, after which they received baths of warm water and soap'' (p. 1178). Diet: ''Either one of two formulas, each containing about 20 calories per ounce, was used. Pooled woman's milk with at least 3 per cent fat was given most frequently, but when this was not available a modified formula consisting of 17 ounces of cow's milk (2 per cent fat) and 3 ounces of 50 per cent solution of Karo syrup was substituted. The amount of food was governed somewhat by the age and weight of the infant, but the average daily caloric value did not exceed 60 calories per pound. Antirachitic and antiscorbutic agents (cod liver oil, haliver oil, viosterol and orange juice) were not administered, as a rule, until the infants weighed at least 4 pounds'' (p. 1178).

STATURE (cm.) OF PREMATURE INFANTS UNDER SPECIAL CARE, BOSTON 1926-29

Absolute length for various weight groups

Weight (lbs.)	Males N	Males Mean	Males Range	Females N	Females Mean	Females Range
1.5 thru 2.4	10	37.5	34.5-39.4	19	35.8	32.0-39.4
2.5 thru 3.4	42	40.6	37.6-43.9	58	40.8	36.6-49.0
3.5 thru 4.4	95	43.7	38.1-48.0	100	43.6	38.1-48.3
4.5 thru 5.4	70	45.9	42.9-49.8	70	46.1	42.4-50.8

Monthly increment in length by sex

Sex	First Month N	First Month Mean Gain	Second Month N	Second Month Mean Gain	Third Month N	Third Month Mean Gain
Males	45	1.7	28	2.7	14	2.8
Females	51	1.6	33	2.4	12	3.0

Monthly increment in length by age

Fetal Age (mos.)	First Month N	First Month Mean Gain	Second Month N	Second Month Mean Gain	Third Month N	Third Month Mean Gain
Under 7	12	1.7	10	2.8	7	3.1
7 to 8	47	1.7	30	2.4	15	2.9
8 and over	33	1.6	18	2.5	4	2.6

Infants younger than seven fetal months at birth showed a tendency to increase in stature during the first three months at a slightly faster rate than infants over eight fetal months at birth. ''No difference was found between the growth of length of boys and of girls'' (p. 1234).

Blatt, Maurice L. **1921** The physical development of tuberculous children. *Amer. J. Dis. Child.*, 21, 575-585.

This investigation compared stature means for age two years derived from measurement of 12 tuberculous and 25 control infants. The latter were either "without any symptoms suggestive of tuberculosis" or "negative to tuberculin tests" (p. 575). The former "gave the characteristic reaction to tuberculin" (p. 575). The nontuberculous infants were obtained through the West Side Jewish Aid Dispensary, Chicago, and the tuberculous through the West Side Jewish Branch of the Municipal Tuberculosis Sanitarium. Both samples were drawn from " a small district in which hygienic, dietetic, economic, and social conditions were decidedly adverse" (p. 575). Measurements on the tuberculous group were apparently taken at the time of admission to the sanitarium.

STATURE (cm.) OF TUBERCULOUS AND NONTUBERCULOUS INFANTS OF LOWER CLASSES

Age (mos.)	Group	Males		Females	
		N	Average	N	Average
24	Tuberculous	6	84.1	6	81.5
24	Nontuberculous	13	83.8	12	83.3

The differences between the tuberculous and control groups were not in the same direction for both sexes. When males and females were combined, the average for the tuberculosis subjects was 0.8 cm. lower than for the control.

Blatt, Maurice L.; **Harris,** Ellis H.; **Jacobs,** Howard M. and **Zeldes,** Mary. **1940** An evaluation of enzyme treated milk in infant feeding. *J. Pediat.*, 17, 435-447.

Comparative findings for stature were obtained on infants receiving "unboiled, pasteurized, enzyme treated milk" and infants given "formulas made with other milks" (pp. 443, 447). Experimental diet: A "pancreatic proteolytic enzyme" was added to raw milk (one part of the enzyme to "20,000 or 30,000 parts of milk") immediately prior to pasteurization. This treatment reduced the curd tension "below 20 Gm.," so that the curds formed from the milk were "soft, flocculent, finely divided, and did not tend to agglomerate" (p. 446). There was no alteration in the "appearance, taste or cream line of the milk" (p. 446). The product was termed enzylac. "The average agar plate count of enzylac milk (300 observations) was 11,162 as compared with a count of 13,411 in ordinary pasteurized milk (252 observations). The average curd tension of the enzylac samples was 12; of the ordinary pasteurized milk, 26" (p. 437). Subjects: 113 full-term infants, studied 1937-40 at the St. Vincent's Infant and Maternity Hospital, Chicago, "initially seen during their first four weeks of life" and under continuous observation for varying periods up to six months. Of the 75 infants placed on enzylac during their first month, 37 remained under observation at age three months and 11 at six months. Of 38 infants placed on control milks during their first month, 18 had been discharged from the institution by three months and 31 by six months.

STATURE (cm.) OF INSTITUTIONALIZED INFANTS OF TWO DIETARY GROUPS

Group	3 mos.		6 mos.	
	Number	Mean	Number	Mean
Experimental	37	58.9	11	66.3
Control	20	59.2	7	67.2

The differences in stature between the infants fed enzylac and those "on formulas made with other milks and by other methods" were considered "not appreciable" (p. 447).

Blatt, Maurice L.; **Harris**, Ellis H.; **Jacobs**, Howard M. and **Zeldes**, Mary. **1941** The effect of fortifying the infant's diet with a cereal enriched by iron, calcium and vitamin B_1. *Arch. Pediat.*, 58, 694-705,

Study was made of the influence on stature from fortifying the infant's diet with a cereal enriched "by the addition of iron, calcium, phosphorus, and stabilized wheat germ (a rich source of vitamin B_1)" (p. 694). Subjects: 128 full-term, White infants between birth and six months of age, each under continuous observation for a period of eight weeks in St. Vincent's Infant and Maternity Hospital, Chicago. Groups: The subjects were matched for sex, age and weight, and split into an experimental and a control group. "Comparable children in each group were kept in the same environment, received the same treatment and ate the same dietary with the exception of the cereal'' (p. 695). Diet: ''During the first three months of life, the diet consisted of milk, dextrimaltose, cod-liver oil, orange juice and cereal. Potatoes were added in the fourth, vegetables in the fifth, and pudding in the sixth month'' (p. 697). The enriched cereal—New 5-Minute Cream of Wheat—''contained 1.01 grams of P_2O_5; 40 milligrams of iron, and 50 to 70 International Units of vitamin B_1 per 100 grams. The control cereal contained 0.19 to 0.23 per cent of P_2O_5; 1 to 2.5 milligrams of iron, and 14 International Units of vitamin B_1 per 100 grams'' (p. 696). For both groups, the cereal was similarly prepared. Below three months of age it was added to the daily formula, at older ages it was fed by spoon. The amount was increased from one teaspoonful daily (under one month) to eight tablespoonfuls. Subgroups: The experimental and control groups were each divided into six subgroups. For one pair of subgroups cereal was added to the diet in the first month, for other pairs it was added in the second, third, fourth, fifth and sixth months respectively. Gross findings: The investigators claimed that of the six paired groups, ''the height increments of four were in favor of the enriched cereal (one significantly so) and two were in favor of the control cereal'' (p. 699). They concluded that the stature of the experimental infants ''showed a trend of superiority over that of those fed control farinas, but the significance of this trend was not established'' (p. 705).

Quantitative results were reported for the pair of subgroups followed from the first to the third month. The investigators considered the simplicity of the basic diet of these groups (milk, dextrimaltose, orange juice and cod liver oil) relatively ideal for registering ''the over-all effect of supplementing the diet with elements such as calcium, phosphorus, iron and vitamin B_1'' (p. 704).

GAIN IN STATURE (cm.) OF INSTITUTIONALIZED INFANTS ON CONTROLLED DIETS

Group	Month Study Began	Experimental Period (wks.)	Number of subjects	Average Gain
Experimental	First	8	10	5.5
Control	First	8	13	4.5

(The magnitude and relationship of these gains make it advisable to supplement their presentation with comparative findings on at least one other group. The annotator has available measurements of stature at ages one and three months on each of 20 Iowa City infants, 10 drawn from the laboring classes and 10 from the professional classes. The infants were born 1940-41 and lived in their own homes. At least three received no cod liver oil and none was fed cereal. The average gain in stature was 6.7 cm., the range in gain from 5.5 cm. to 7.9 cm. Still higher figures would have accrued had the two-month period—8.7 weeks—commenced during the first month rather than at the close of the month. In this connection, it is relevant to note that Blatt, Harris, Jacobs and Zeldes stated that many of their first-month infants "started on cereal as early as one week of age.")

Blatt, Maurice L.; **Jacobs,** Howard M.; **Murphy,** John B. and **Zeldes,** Mary. **1941** The addition of homogenized vegetables to the diet of the young infant. *Arch. Pediat.*, 58, 40-47.

Gains in stature for infants receiving diets supplemented with homogenized vegetables were reported. Subjects: 23 infants between one and six months of age, each studied over a period of four months at St. Vincent's Infant and Maternity Hospital, healthy except for infections of the upper respiratory tract in about half the cases. Basal diet: All subjects were fed the "same basic milk formula, cod liver oil and orange juice, varying in amount according to age and weight" (p. 41). Subgroups: The homogenized vegetable mixture—affording "54 mg. of phosphorus, 1.58 mg. of iron, and 0.15 mg. of copper per 100 grams" (p. 41) —was introduced into the diet at different ages. For four infants aged one to two months, one teaspoonful was added in the daily formula and increased by one teaspoonful every second week up to three tablespoonfuls. For nine infants aged two to three months, two teaspoonfuls were added in the daily formula and increased by two teaspoonfuls every second week to four tablespoonfuls. For four infants aged three to four months, two teaspoonfuls were fed by spoon daily and increased as for the previous group. For four infants aged four to five months, one teaspoonful was fed by spoon daily and increased as for the two foregoing groups. For two infants aged five to six months, one tablespoonful was fed daily and increased as with all other groups except the first.

STATURE GAINS (cm.) FOR INFANTS FED HOMOGENIZED VEGETABLES AT DIFFERENT AGES

Month Vegetables Added to Diet	Experimental Period (mos.)	Number of Subjects	Average Gain
Second	4	4	11.0
Third	4	9	10.7
Fourth	4	4	8.9
Fifth	4	4	7.8
Sixth	4	2	6.0

It was not made clear whether these figures were considered to warrant any conclusions regarding the relation between stature and the addition of homogenized vegetables to the diet. The figures were not aligned with any values for comparable groups not receiving homogenized vegetables. It would be untenable to assume that the finding of a decrease in stature gain for successive age groups constitutes in itself a measure of the effect of postponing the age at which homogenized vegetables are added to the diet—this follows since for all infants not grossly pathological it is well established that gain in stature is greater between the second and sixth month than between the fourth and eighth month, and greater between the fourth and eighth month than between the sixth and tenth month (see p. 50).

Blatt, Maurice L. and **Schapiro,** I. E. **1935** Influence of a special cereal mixture on infant development. *Amer. J. Dis. Child.*. 50, 324-336.

Investigation was made of the influence on stature from inclusion of a special cereal mixture in the infant's diet. Subjects: 136 well children, ranging in age from three to thirty months; housed at St. Vincent's Infant and Maternity Hospital, Chicago, during 1931-33; "observed for periods varying from 6 weeks to 1 year" (p. 325). Diet: "Cow's milk with dextrimaltose formed the basis of the infants' diet. A regimen of orange juice and cod liver oil was begun during the first month. Cereal became a dietary component when the infant was 3 months old. Vegetables and soups were given at 5 months. Eggs and puddings were added during the ninth month. At 1 year the children were receiving a general diet which included whole boiled milk, cereals, vegetables, soups, puddings, toast, eggs, bacon, stewed fruits, cod liver oil and orange juice" (p. 325). Subgroups: A control series of 66 infants "received the commonly used cereals,'' while an experimental series of 70 infants were fed a cereal mixture enriched with vitamin B and having a mineral content of ''total ash, 3.2 per cent; calcium, 0.78 per cent; phosphorus, 0.62 per cent; iron, 0.024 per cent, and copper, 0.0013 per cent'' (p. 324). The subjects in each group were ''about equally divided as to sex'' and ''there were 4 Negro children in each group'' (p. 326). ''All cereals were cooked with half milk and half water in a steam kettle for one-half hour and were fed as a part of the morning meal. The quantity fed was dependent on the appetite of the child'' (p. 325).

STATURE (cm.) OF HEALTHY INSTITUTIONALIZED INFANTS ON CONTROLLED DIETS

Group	6 mos.	12 mos.	18 mos.	24 mos.
Experimental	64.7	71.6	76.3	83.7
Control	64.5	72.0	76.5	82.4

Blatt and Schapiro claimed they had compared ''two groups of children in good health, living under as nearly ideal conditions as institutional life permitted,'' and found that ''the group fed the special cereal mixture exceeded the control group in total length'' (pp. 326, 336).

Was this conclusion warranted? To the annotator it appears questionable whether the quantitative results could be considered to give dependable support to any statement comparing the two groups—particularly since no information was afforded on the number of cases examined at each age or on the number of subjects followed for six weeks only and for longer intervals to one year.

Compared with the means at comparable ages from other studies, Blatt and Schapiro's values for both the experimental and control groups were unusually low. See, for example, Table IXa of the appendix.

Bovaird, David, and **Nicoll,** Matthias. **1906** The weights of the viscera in infancy and childhood, with special reference to the weight of the thymus gland. *Arch. Pediat.*, 23, 641-668.

Stature data were reported on a series of cadavera measured ''at the New York Foundling Hospital during three years'' (p. 643). Subjects: Excluding infants considered markedly premature and ‘‘cases loosely described as marasmus’’ (i.e., ‘‘infants who die . . . apparently from inability to derive nourishment from their food’’), there were 386 specimens (approximately 200 males and 180 females) falling within the age period from two postnatal months to nineteen and one-half months. Care prior to death: Whenever ‘‘sufficiently ill to require constant medical attendance’’, the subjects had been under treatment at the New York Foundling Hospital; otherwise, most of the subjects had been ‘‘nursed by wet nurses from birth, and cared for by them at their homes (generally tenements) under supervision of the hospital authority’’ (p. 643).

STATURE (cm.) OF DECEASED INFANTS

Age Group Midpoint	Range (mos.)	Number	Mean	Range
1	.5 to 1.5	14	51.6	47.0-56.0
3	1.5 to 4.5	53	56.7	49.0-65.5
6	4.5 to 7.5	86	62.2	55.0-75.0
9	7.5 to 10.5	119	66.8	57.0-80.0
12	10.5 to 13.5	74	68.3	60.0-80.0
15	13.5 to 16.5	25	71.3	63.0-80.0
18	16.5 to 19.5	15	73.2	65.0-85.0

The ‘‘last illness,’’ or ‘‘cause of death,’’ was given on each subject. For the shortest and longest infants represented in the foregoing tabulation, the listings were: At one month, lobar pneumonia (shortest) and enterocolitis (longest); at three months, broncho pneumonia with acute colitis and broncho pneumonia with lymphatism; at six months, congenital syphilis and gastroenteritis; at nine months, broncho pneumonia and enterocolitis; at twelve months, broncho pneumonia and rickets with enterocolitis; at eighteen months, empyema with miliary tuberculosis and broncho pneumonia.

For the first year, Bovaird and Nicoll's means were found to be similar to those of Francis (1940) on cadavera, and of Bakwin and Bakwin (1931) on infants with ‘‘acute intestinal intoxication’’. Compared with the means on cadavera from Coppoletta and Wolbach (1933) there was close similarity at one, three, six and nine months, while the Bovaird and Nicoll values were the lower by over four centimeters at twelve and eighteen months respectively.

Bowditch, H. P. **1872** Comparative rate of growth in the two sexes. *Boston Med. and Surg. J.*, 10, 434-435. (Also, *Report of 50th meeting of British Assoc. for Advancement of Sci.*, 1880, 140-147.)

Stature measurements were obtained on 15 infants between the ages of one and two years. The data were collected around 1850. Subjects: All "nearly related to each other." Parents: "American"; professional socio-economic group; partially, if not exclusively, residents of Massachusetts.

STATURE (cm.) OF INFANTS OF A RESTRICTED LINEAL AND CULTURAL GROUP

Midpoint of Age Group	Males N	Males Av.	Males Range	Females N	Females Av.	Females Range
18 mos.	8	73.9	66.5-82.0	7	70.8	63.5-79.0

The average stature for male infants was found to exceed that for female infants.

Boyd, Edith. **1941** *Outline of physical growth and development.* Minneapolis: Burgess Publishing Co. Pp. 119 (43 figs. + 33 tables + 43 text and bibliography).

This reference incorporated an analysis of stature data taken on infants of Minneapolis, Minnesota. The measurements were obtained with the subjects "in supine position." It is probable the subjects were drawn from the upper and middle socio-economic groups.

STATURE (cm.) of "MINNEAPOLIS INFANTS"

Age (mos.)	Males Number	Males Mean	Males S.D.	Females Number	Females Mean	Females S.D.
Birth	15	51.3	1.7	10	49.5	2.2
6	24	68.0	1.8	15	65.2	2.4
12	15	77.3	2.1	8	74.7	2.6
18	17	83.2	2.3	5	82.2	2.8
24	12	88.5	2.5	4	87.2	3.0

The means were "read from smoothed trends drawn to observed means" and the standard deviations "computed from regression equations fitted to observed standard deviations" (p. 51).

Boyd, Julian D. and **Nelson**, Martha V. **1928** Growth studies of children with diabetes mellitus. *Am. J. Dis. Child.*, 35, 753-761.

Stature data were presented on 32 diabetic children under dietary control for periods varying from three months to four years. Only one case was below two years of age. This subject, sex not given, was followed over the age period from twelve to eighteen months. Diet: Slightly more than one gram of protein was included "for each pound of theoretical weight as determined by the height . . . In general the fatty acid dextrose ratio was 1½:1" (p. 754). The study was carried out at the Department of Pediatrics, University Hospitals, Iowa City.

STATURE (cm.) OF DIABETIC INFANT ON CONTROLLED DIET

12 mos.	18 mos.	Gain 12 to 18 mos.
78.7	82.4	3.7

(This gain of 3.7 cm. may be appropriately aligned with gains made over the same age period by 26 non-diabetic infants studied at approximately the same time—1925-29—and residing in the same geographic region—Iowa City. The mean increment for the 26 infants was 6.5 cm. Increases of less than 5.0 cm. were obtained for three cases only, and the minimum gain was 3.3 cm.)

For their study as a whole, Boyd and Nelson concluded that "uncomplicated diabetes mellitus" was "not incompatible with normal growth" if "adequately" controlled—such control implying "approximation and maintenance of normal blood sugar values and an adequate diet" (pp. 760-1).

Boynton, Bernice. **1936** The physical growth of girls: A study of the rhythm of physical growth from anthropometric measurements on girls between birth and eighteen years. *Univ. Ia. Stud. Child Welf.*, 12, No. 4. Pp. 105.

Stature values were reported from an analysis of "anthropometric records made for girls." Material: Records accumulated 1926-35 on 145 "physically normal white girls" examined at the infant laboratory of the Iowa Child Welfare Research Station, University of Iowa. Parents: Residents of Iowa City, largely native-born, over 90 per cent from northwest European ethnic groups, more than one-half of the professional and managerial classes.

STATURE (cm.) OF IOWA CITY FEMALE INFANTS OF "ABOVE AVERAGE" CLASSES

Age Group Mid-point	Range (mos.)	N	Mean	S.D.	V	Range	Increase in Mean Absolute	Increase in Mean %-age
3	1.5 to 4.5	43	59.9	3.14	5.2	52.5-68.5		
6	4.5 to 7.5	93	65.9	2.78	4.2	57.0-72.5	6.0	10.1
9	7.5 to 10.5	107	70.3	2.71	3.9	61.2-76.5	4.4	6.6
12	10.5 to 13.5	103	74.4	2.64	3.6	67.5-81.2	4.1	5.8
15	13.5 to 16.5	83	78.2	2.43	3.1	72.6-82.5	3.8	5.1
18	16.5 to 19.5	71	82.2	2.39	2.9	76 2-86.7	4.0	5.1
21	19.5 to 22.5	67	85.0	2.65	3.1	80.0-89.8	2.8	3.5
24	22.5 to 25.5	71	86.9	2.78	3.2	79.0-93.9	1.9	2.2

Using a mean stature for Iowa City females at age seventeen years as representative of stature "magnitude at maturity," the mean at one year was found to equal 46 per cent and that at two years 54 per cent.

Brines, John K.; **Gibson**, John G. and **Kunkel**, Paul. **1941** The blood volume in normal infants and children. *J. Pediat.*, 18, 447-457.

Measurements of stature were reported for six male and four female infants. The subjects were "regarded as having normal cardiovascular, renal, respiratory, and digestive systems" (p. 450). Stature was obtained as "recumbent length from soles to vertex, measured with a steel tape with the subject lying on a flat surface" (p. 450).

STATURE (cm.) OF TEN BOSTON INFANTS

Age	Males		Age	Females
19-20 days	49.7	55.5	7 days	52.5
5 mos.	64.6	71.0	21 days	52.1
6 mos.	64.5		19 mos.	89.0
10 mos.	70.0		20 mos.	78.0

Bruch, Hilde. **1939** Obesity in childhood: I. Physical growth and development of obese children. *Amer. J. Dis. Child.*, 58, 457-484.

In a study to discover "how obese children compare with normal ones with regard to those phases of growth which are not expressed by weight," Bruch incorporated a measurement of stature on one case as young as two years. Subject: Female infant, age twenty-four months, weight 23.6 kg., American-born, White or Negro, examined about 1937 at Babies Hospital or Vanderbilt Clinic, New York City. Finding: Stature at age twenty-four months was 94.6 cm., or upwards of two centimeters higher than the maxima reported for females in such studies of normal infants as those by Freeman (1931), Maresh and Washburn (1938), Stuart (1934), and Wallis (1931). Of the total series of White females aged twenty-four months analyzed by Woodbury (1921), the maximum stature was 104.0 cm., though not more than 1 per cent of the infants exceeded 94.0 cm. Conclusion: Stature was "in excess of the average normal" (p. 484).

Capper, Aaron. **1928** The fate and development of the immature and of the premature child. *Amer. J. Dis. Child.*, 35, 443-491.

This paper afforded graphic portrayal of stature values for 18 infants with birth weights not exceeding 2500 gm. Data: Seemingly accumulated at the Department of Pediatrics, Jefferson Medical College, Philadelphia. Subgroups: 13 infants weighing 1501 gm. to 2500 gm. at birth (5 males, 8 females) and 5 females with birth weights 1500 gm. or less.

STATURE (cm.) FOR EACH OF EIGHTEEN INFANTS OF LOW BIRTH WEIGHT

Age (mos.)	Under 1500 gm. Females	1501-2500 gm. Males		1501-2500 gm. Females	
4		45.5	47.5		
8-9	37.5			57.0	
11-12	60.0	65.5		60.0	63.0
15-16	66.0	69.8		66.5	74.0
18-19	70.2			73.0	
20-21	73.5			72.0	80.5
24		80.2			

For the four infants each at the extra-uterine ages of eleven and twelve months, fifteen and sixteen months, and nineteen to twenty-one months, the means were 62.1 cm., 69.1 cm., and 74.1 cm., respectively. Compared with infants weighing more than 2500 gm. at birth, Capper found infants of lower birth weight generally "lagging" in stature magnitude.

Cates, H. A. and **Goodwin,** J. C. **1936** The twelve-day-old-baby. *Hum. Biol.,* 8, 433-450.

Central tendency and variability values for recumbent stature were presented on 672 neonates "born in the Obstetrical Department of the Toronto General Hospital" during the three-year period 1933-35. Subjects: "normal," "full-term" infants (cases designated by the obstetrician as "premature" or "over-term" were rejected). The measurements were made by Drs. D. Borsook, J. C. Goodwin, and D. Irwin. Special attention was given to the reliability of the data.

STATURE (cm.) OF TORONTO NEONATES BORN 1933-35

Age Group (days) Midpoint	Age Group (days) Range	Males N	Males Mean	Males S.D.	Males V	Females N	Females Mean	Females S.D.	Females V
12	11 thru 14	345	51.8	2.03	3.9	327	50.9	1.86	3.7

"In total body length the male child at 12 days exceeded the female by approximately 2 per cent" (p. 442). Compared with the female "the male showed somewhat greater variability" (p. 445). The range for both sexes together was given as 46.0 cm. to 58.0 cm.

Chaille, Stanford E. **1887** Infants, their chronological progress. *New Orleans Med. and Surg. J.,* 14, 893-912.

This paper was intended to aid physicians and parents "estimate aright the progress which the ordinary average baby ought to make" (p. 893). The research materials utilized were not specified: If the paper was based upon original data, no indication was given of the source and size of the sample, or of its racial and socio-economic composition. Average stature was stated to approximate 49.5 cm. at birth, 61.0 cm. at six months, and 68.5 cm. at one year.

These 1887 "guides in determining what should be the growth of a healthy average child" are shown in Part I to be markedly different, particularly at six months and one year, from figures representing the decade 1930 to 1940 (see pp. 11-15).

Chapin, Henry Dwight. **1894** A plan of infantile measurements. *Med. Rec.,* 46, 649-651.

Measurements of recumbent stature on 98 infants ranging in age from birth to two years were obtained. The subjects were "much below par," many "presented evidence of rickets" (p. 650). No discussion was given of their racial stocks beyond reference to one case as Polish. All observations were made "by extending the child upon a graduated board with a moveable slide at one extremity" (p. 649).

STATURE (cm.) OF MALNOURISHED INFANTS

	Birth	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.
Number	9	27	9	13	6	14
Average	49.7	56.6	59.8	65.1	69.3	75.7

The averages obtained at one year and at eighteen months were no lower than those reported by Chaille (1887) and Peckham (1882) for presumably "healthy" infants.

Christie, Amos U.; **Dunham,** Ethel C.; **Jenss,** Rachel M. and **Dippel,** A. Louis. **1941** Development of the center for the cuboid bone in newborn infants. *Amer. J. Dis. Child.,* 61, 471-482.

Stature data on 1107 infants "measured within seventy-two hours of birth" were included in this paper. The data had been accumulated between 1936 and 1938 "in the ward service of the Johns Hopkins Hospital," and were analyzed at "the Division of Research in Child Development and the Division of Statistical Research of the Children's Bureau" (pp. 471-2). Subjects: 630 infants born to primiparae (164 White males, 144 White females, 146 Negro males, 176 Negro females) and 477 infants born to multiparae (133 White males, 122 White females, 122 Negro males, 100 Negro females). All were "born alive . . . single born, nonsyphilitic'' (p. 472). Infants ''born to mothers under the care of private physicians were excluded'' (p. 472).

PERCENTAGE OF NEWBORN WARD INFANTS IN EACH OF THREE STATURE CLASSES

Group	Less than 47.0 cm.	47.0 to 49.9 cm.	50.0 cm. or more
Infants born to primiparae:			
White males	15.2	42.7	42.1
White females	18.8	50.0	31.2
Negro males	32.2	40.4	27.4
Negro females	31.2	57.4	11.4
Infants born to multiparae:			
White males	9.0	30.1	60.9
White females	13.9	49.2	36.9
Negro males	16.4	57.4	26.2
Negro females	20.0	62.0	18.0

Using ''length at birth of less than 47 cm.'' as a criterion for prematurity, 14.4 per cent of the 563 White infants and 26.1 per cent of the 544 Negro infants were ''premature.'' Of those neonates with statures 47.0 cm. and above, the percentages measuring ''50 cm. or more'' were 57.7 for White males, 40.5 for White females, 35.8 for Negro males, and 18.9 for Negro females.

Clagett, Dorothy D. and **Hathaway,** Milicent L. **1941** Basal metabolism of normal infants from three to fifteen months of age, with special reference to twins. *Amer. J. Dis. Child.*, 62, 967-980.

These authors collected seriatim stature records over periods not exceeding eight months at ''the Department of Foods and Nutrition, New York State College of Home Economics, Cornell University'' (p. 967). The records were obtained in connection with a study of basal metabolism. Subjects: ''Eight healthy infants . . . Marie and Marcia, born Nov. 16, 1936, were identical twins; Paul and Patricia, born July 16, 1937, and Warren and George, born July 23, 1938, were fraternal twins; John, born July 24, 1938, and Walter, born July 27, 1938, were unrelated, but they lived under similar conditions'' (p. 969).

STATURE RECORDS (cm.) OBTAINED 1937-38 ON EIGHT INFANTS

Age	*Identical Twins*		*Fraternal Twins*				*Non-Twins*	
(mos.)	Marie	Marcia	Paul	Patricia	Warren	George	John	Walter
4.7			61.6	63.5				
5.5					68.5			
5.8								66.0
6.1		65.4	64.8	64.8				
7.3	68.6	68.6						
7.7						69.2		
8.0								70.5
8.1			67.3	67.3				
8.2							67.9	
8.3	69.2	69.2						
8.6					73.0	69.8		
9.5					74.9			
9.6						72.4		
10.8	71.8							
10.9		72.4				73.7		
12.0		73.0						
12.9	74.3	74.9						
13.8	74.9	76.2						

Referring first to the two sets of fraternal twins, Paul and Patricia gave identical statures at six and eight months, while Warren and George differed by approximately three centimeters at nine months. At one year of age, the stature of Marcia (identical twin) was practically the same as the average reported by Bakwin, Bakwin, and Milgram (1934) for female infants from a "poverty-stricken district" of New York City.

Cook, Paul. **1921** A clinical study of the premature infant. *Arch. Pediat.*, 38, 201-216.

Stature data for 77 neonates born prematurely were analyzed. Material: 73 records from single pregnancies and two from twin births; accumulated 1914-21 at the Department of Pediatrics, University of California Medical School, San Francisco. Mothers: 78 per cent of North European ancestry, 12 per cent from southern and eastern Europe; average age 28 years; average parity three plus; average duration of gestation 7.3 months, range 6 to 8.5 months.

STATURE (cm.) OF PREMATURE INFANTS AT BIRTH

Total Series		Infants Surviving		Infants Dying	
N	Av.	N	Av.	N	Av.
77	42.4	44	43.4	33	40.1

"The shortest infant in the series was 31 cm. long at birth and survived" (p. 211). The youngest infant to survive "was born at 6 months, according to the history," and had a length of 41.0 cm.

Coppoletta, Joseph M. and **Wolbach,** S. B. **1933** Body length and organ weights of infants and children: A study of the body length and normal weights of the more important vital organs of the body between birth and twelve years of age. *Amer. J. Pathol.,* 9, 55-70.

An analysis was included of selected autopsy records for stature accumulated 1914-29 at "the Children's and Infants' Hospitals," Boston. Of the total available records for infants, over one-half—those marked abnormal, premature, or diseased—were rejected. Subjects: 203 deceased infants, not described with reference to sex, racial derivation or socio-economic selection.

STATURE (cm.) OF "NORMAL" CADAVERA

	Birth	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.
Number	15	30	44	43	18	11	22	20
Mean	49.0	52.0	57.0	62.0	67.0	73.0	78.0	84.0

For the period from one month to nine months, these means were similar to those of Bovaird and Nicoll (1906) on cadavera and of Bakwin and Bakwin (1931) for infants with "acute intestinal intoxication." During the second year they were approximately equivalent to the Woodbury (1921) means for White infants examined during the "Children's Year."

Crum, Frederick S. **1916** Anthropometric statistics of children—ages six to forty-eight months. *Publ. Amer. Statist. Assoc.,* 15, 332-336.

Means for stature derived from measurement of 7126 infants aged six months to two years were reported. Data: Collected 1913 to 1916 in thirty-one states, "according to uniform rules," at Better Babies Contests sponsored by the *Women's Home Companion* and Baby Health Conferences fostered by the American Medical Association. Parents: Majority American-born; "of different stocks, including German, Irish, Swedish, some Italian, and some of various other races" (p. 336). Means were given at monthly intervals.

STATURE (cm.) OF "BABY CONTEST" AND "HEALTH CONFERENCE" INFANTS

Age	Males		Females	
(mos.)	Number	Mean	Number	Mean
6	259	67.3	176	65.7
9	211	71.4	183	70.2
12	284	74.6	228	73.3
15	215	78.1	197	76.5
18	181	80.6	178	79.1
24	201	85.7	160	84.8

As later emphasized by Woodbury (1921), these findings were "based upon infants who were brought for baby health conferences, or 'baby shows,' in many of which prizes were given the most perfectly developed children, and there may well have been a tendency to bring only the more well-developed babies" (pp. 37-38).

Dafoe, Allan Roy and **Dafoe,** William A. **1937.** The physical welfare of the Dionne quintuplets. *Canadian Med. Assoc. J.*, 37, 415-423. (See also, MacArthur, John W. and Dafoe, Allan Roy. 1939 Genetics of quintuplets: II. Trends of growth in the Dionne quintuplets. *J. Hered.*, 30, 359-364.)

A chart was presented showing the growth in stature of each of the Dionne quintuplets. Subjects: Five "identical" or monozygotic siblings; females; prematurely born by approximately two months; weight one week after birth varied between 680 gm. (Marie) and 1100 gm. (Yvonne). Parents: French-Canadians living in a rural farmhouse near Callander, Ontario. Diet: Breast milk until 4.5 months of age; tomato and orange juice begun at five weeks, cod liver oil at eight weeks, ferrous chloride and prune juice about four months, cereal at five months, egg yolk, cooked vegetable and fruit pulps in eighth month, and calves liver at one year. Illness: Each had a "moderately severe infection" for one week in the fourth month—cough, nasal discharge, temperature, diarrhea, cramp and distention; in the eleventh month each had a head cold, cough and temperature; with the exception of Emelie, each had a head cold in the fourteenth month; shortly before eighteen months and again in the twenty-first and twenty-second months, each had head colds in conjunction with vomiting and loose stools. Health care: Exceptionally well controlled provisions for health protection and supervision; the amount of sleep approximated eighteen hours per day during the first eighteen months, and fourteen hours or more during the latter part of the second year; all received "three diphtheria toxoid injections at three-week intervals when 1½ years of age" (p. 422).

MEAN STATURE (cm.) OF FIVE PREMATURELY BORN, MONOZYGOTIC, FEMALE INFANTS

Birth	6 mos.	12 mos.	18 mos.	24 mos.
33.9	55.2	69.1	76.6	79.3

The range in stature was about 33.0 to 34.5 cm. at birth and 77.5 to 80.3 cm. at two years; at both ages the low values were for Marie and the high values for Yvonne. Gains in stature from birth to two years fell between 44.5 cm. (Marie) and 46.2 (Annette), with a mean of 45.4 cm. This mean increment was higher by 9.3 cm. than the difference between the stature means for birth and two years from Stuart's (1934) full-term, clinic supervised females.

Daniels, Amy L. and **Hejinian,** Lucea M. **1929** Growth in infants from the standpoint of physical measurements and nitrogen metabolism: I. Creatinine. *Amer. J. Dis. Child.*, 37, 1128-1134.

In this investigation, the relation of excretion of creatinine to age, weight and stature was studied. Nine male infants were under observation over varying periods between the ages of two and eight months. In the case of four subjects, stature was determined at three and at six months. Diet: From "18 days of age" the subjects received "feedings of modified cow's milk. Orange juice and cod liver oil were given daily" (p. 1129).

STATURE (cm.) OF FOUR IOWA MALES ON CONTROLLED DIET FROM FIRST MONTH

Subject	3 mos.	6 mos.	Gain 3 to 6 mos.
A	58.5	65.9	7.4
B	61.4	67.2	5.8
C	61.7	68.5	6.8
D	65.5	73.5	8.0

For these four cases, the mean at three months was 61.8 cm. and at six months 68.8 cm. The mean gain between three and six months was 7.0 cm. The shortest male at six months had practically the same stature as the tallest at three months. The largest amount of gain was made by the tallest case and the second largest amount by the shortest case.

Davenport, Charles B. **1938** *Bodily growth of babies during the first postnatal year.* Carnegie Institution of Washington, Publ. No. 496, Contr. Embryol., No. 169, 271-305.

This study, which encompassed a consideration of growth in stature between the postnatal ages of one month and one year, was made at the Normal Child Development Study, Babies Hospital, New York City. Subjects: 34 infants, 19 males and 15 females, born 1933-36; 79 per cent of northwest European descent and the remainder mainly Italian; all fed so that "the vitamin requirements for growth were satisfied" (p. 273). The data were collected exclusively by the investigator, with careful attention to reliability.

STATURE (cm.) OF INFANTS "AT ABOUT ONE MONTH AND AT ABOUT ONE YEAR"

	1 mo.			12 mos.		
	Mean	S.D.	V	Mean	S.D.	V
Absolute magnitude	54.1	2.67	4.9	75.2	2.33	3.1
Rate of gain per month	3.1	1.44	47.0	1.5	1.08	71.5

It was not stated whether the full 34 cases were examined at each age. Mean stature at the latter age exceeded that at the former by 21.1 cm. The mean gain per month decreased from 3.1 cm. at one month to one-half this amount at one year.

Individual stature curves were presented for three of the male infants and one female:

Subject	Sex	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.
A	Male	57.6	66.0	71.9	76.6	80.7
B	Male	55.2	59.2	68.3	72.9	79.2
C	Male	56.2	64.0	72.9	77.3	
D	Female	50.7	57.0	62.2	67.5	71.0

Subjects A and C were both of Scotch-Irish descent; A's stature exceeded C's at one and three months but was exceeded by C's at six and nine months; roentgenograms on C showed slight rickets at nine months. B, "of American descent," was shorter than A throughout—B had acute intestinal intoxication in early part of second month while A had chronic nasopharyngitis in tenth month and acute otitis media at eleven months. D, "American" father and "Canadian" mother, had bilateral mastoiditis operation in tenth month.

Davenport treated the form of individual stature curves. Graphs of the seriatim measurements, using age as abscissa and stature as ordinate, gave curves for the first year "concave to the base" (p. 281). "Various hypotheses" that had been proposed to "account for" the fact that the curves were "not rectilinear" were reviewed. None was found completely adequate. No more specific statement than the following was considered warranted: "The velocity of growth depends both upon the internal chemical condition of the infant and the nature of the food supply; and the internal chemical condition is doubtless chiefly determined by the quality of the genes of the organism—its heredity" (p. 292).

Davenport, Charles B. and **Drager,** W. **1936** Growth curve of infants. *Proc. Nat. Acad. Sci., Wash.*, 22, 639-645. (See also, Davenport, Charles B. 1938 *Bodily growth of babies during the first postnatal year*. Carnegie Institution of Washington, Publ. No. 496, 271-305.)

Results were reported from an attempt to express growth in stature during infancy as a mathematical equation. Data: The authors claimed to have utilized seriatim measurements made at the Normal Child Development Clinic, Columbia University, on "about twenty babies" (p. 639). Analysis: The record for each subject was treated "individually" in order to avoid the possible "confusing result of combining many unlike curves" (p. 639). Findings: a) Growth in stature from birth to two years was not "well fitted by a parabola" or "a simple logarithmic curve" (p. 639), b) better graduation was obtained with a three-term exponential equation, though for "practically all children" this gave values too low "from five to nine months" and too high "from sixteen to twenty-one months" (p. 640). Inference: Growth in stature during infancy was "probably too complex to be completely expressed in any single formula" (p. 645).

Incorporated in Davenport and Drager's paper was a plot of over two dozen stature measurements taken on a single female infant. Subject: Born 1933, of "American descent," received "the vitamin requirements for growth" and, except for a mild respiratory infection during one week of her fourteenth month, developed "normally."

STATURE (cm.) OF A FEMALE WHITE INFANT BORN IN NEW YORK CITY 1933

1 wk.	3 mos.	6 mos.	9 mos.	12 mos.	15 mos.	18 mos.	24 mos.
51.8	59.7	65.1	70.0	73.0	76.4	79.2	84.0

The female infant studied by Shinn (1893) was 1.6 cm. shorter than this case at age six months. At two years of age, both cases gave practically identical stature records.

Elias, Herbert L. and **Turner,** Reuben. **1936** A clinical study of the influence of vitamin B supplements. I. On growth and development during infancy. *J. Pediat.*, 8, 352-362.

Well infants were studied over the first postnatal year to determine the influence on stature of "presumably large quantities of the Vitamin B complex in the form of wheat germ and brewer's yeast" (pp. 354-5). Subjects: 238 White infants born at Bellevue Hospital, New York City, 1933-35; residents of a poverty-stricken district; artificially fed; enrolled in the Bellevue clinic for well infants. "Twins, prematurely born infants, and infants developing a major illness were excluded" (p. 355). Diet: "whole milk and water up to the child's fluid requirements with 1 ounce of added dextrimaltose . . . The calorie intake varied from 50 to 55 calories per pound of body weight. All infants received orange juice after the first month and from October to May cod liver oil up to 3 teaspoons daily, depending on the age of the infant. Cooked cereal was added to the diet during the fourth month . . . Mothers were advised to offer a tablespoon of the cooked cereal daily and to increase this gradually until 6 to 8 tablespoons were being given. Pureed vegetables, egg yolk, and banana were added during the sixth month, stewed fruit and scraped beef during the eighth and ninth months'' (pp. 355-6). Subgroups: 117 infants received plain dextrimaltose and cereal lacking wheat germ and yeast, 121 infants were fed dextrimaltose with added wheat germ and yeast (105 B_1 and 60 B_2 Chick and Roscoe units in each ounce) and cereal containing added wheat germ and yeast. Experimental period: About one-third of the infants were followed throughout the first year, the minimum period of observation was fifteen weeks, the average period was forty weeks for each group.

STATURE (cm.) OF TWO SUPERVISED GROUPS OF NEW YORK CITY INFANTS

Age Group		*Vitamin B Group*		*Control Group*	
Midpoint	Range (wks.)	Number	Mean	Number	Mean
12	8 thru 15	56	60.1	52	59.8
28	24 thru 31	64	67.2	59	67.3
40	36 thru 43	48	71.0	45	71.4
52	48 thru 55	41	75.5	29	74.8

There were ''no consistent differences between the two groups.'' The mean stature of both groups was ''superior to that of unsupervised children in the Bellevue district . . . studied by Bakwin, Bakwin and Milgram'' (p. 356).

Eliot, Martha M.; **Nelson,** E. M.; **Barnes,** Donald J.; **Browne,** Florence A. and **Jenss,** Rachel M. **1936** A study of the comparative value of cod liver oil, viosterol, and vitamin D milks in the prevention of rickets and of certain basic factors influencing their efficacy. *J. Pediat.*, 9, 355-376.

Investigation was made of the rate of growth in stature in relation to various antirachitic substances. The study was carried out in cooperation with the Children's Hospital of Michigan, the Detroit Departments of Health and Welfare, and the Children's Fund of Michigan on children between the age limits of one week and nine months ''living in their own homes'' (p. 355). Subjects:

567 Detroit infants, 59 per cent White and 41 per cent Negro, 52 per cent males and 48 per cent females; born 1933-35 during the fall and early winter; "born at term . . . result of single pregnancies" (p. 357); "artificially fed or breast fed with a supplemental formula containing not less than twelve ounces of milk daily" (p. 358); supplied an antirachitic substance—either cod liver oil or viosterol or one of four forms of evaported vitamin D milk. Experimental periods: These were always "during the winter (September to May) when the influence of sunlight was almost negligible" (p. 362); they varied for different subjects from two to eight months, the mean duration being roughly five months. Subgroups: The antirachitic agent and dosage was kept constant for each subject, making possible the formation of subgroups. In U.S.P. units the daily dosage levels were between 135 and 400 for the milks, 270 to 810 for cod liver oil and 675 to 2000 for viosterol. Stature data: For each infant, vertex-heel length was measured at intervals of around one month, the obtained values were graduated by a straight line equation, and this equation used to estimate the "average monthly increase in length" during the period of observation. The experimenters noted: "It would have been preferable, of course, to have examined all of the infants over exactly the same age interval" (p. 360).

STATURE (cm.): MEAN GAIN PER MONTH FOR INFANTS UNDER NINE MONTHS OF AGE

	White				*Negro*			
	Males		Females		Males		Females	
Group	N	Mean	N	Mean	N	Mean	N	Mean
Total	183	2.5	152	2.3	114	2.5	118	2.4
Vitamin D milk	102	2.5	76	2.4	47	2.6	47	2.4
Cod liver oil	52	2.5	38	2.3	39	2.5	34	2.5
Viosterol	29	2.4	38	2.3	28	2.4	37	2.3

For the total sample, there was " a significant difference in the growth in length of the two sexes, the male infants, on the average, growing more rapidly than the female" (p. 368). With reference to the "type of antirachitic agent," there was "no real difference between the average increase in length for the infants of a given sex and color" (p. 368).

Study was also made of the incidence of rickets for sub-divisions of the data by antirachitic dosage and rate of stature gain. Procedure: Incidence of rickets was determined from roentgenograms of the forearm bones; infants of each sex and color were subgrouped as receiving above or below 400 U.S.P. units of vitamin D daily and as increasing more or less than average in stature. For 10 infants only did the "advance in the rachitic process" exceed a "slight degree" (p. 361).

STATURE GAIN (cm.) AND VITAMIN D DOSAGE IN RELATION TO MILD RICKETS

	U.S.P. units of vitamin D per day			
	Below 400 units		400 units and up	
Rate of gain in stature	Number of cases	Percentage incidence of rickets	Number of cases	Percentage incidence of rickets
Below average:				
White males	58	40	35	29
White females	39	23	36	39
Negro males	27	30	29	21
Negro females	31	26	30	17
Average and up:				
White males	51	26	39	40
White females	48	25	29	52
Negro males	28	36	30	30
Negro females	25	20	32	22

Findings: "The incidence of slight rickets" was "closely and consistently related to growth in length when the dosage of the antirachitic was relatively high, whereas for infants in the lower dosage group there was no consistent difference in the incidence of rickets" (p. 375). Interpretation: "at the higher level the balance between rickets-producing and rickets-preventing factors was stabilized to such an extent as to allow rate of growth in length to become evident. On the other hand, when a smaller amount was given, the effect of the growth in length was lost in the stronger influence of the inadequate amount of vitamin D" (p. 375).

Fleischner, Emanuel C. **1906** The relation of weight to the measurements of children during the first year. *Arch. Pediat.*, 23, 739-757.

Stature differences were investigated for 500 infants "divided rather arbitrarily into well nourished, fairly well nourished, and poorly nourished classes." Subjects: "all under a year old, . . .

all hospital patients'' at the New York Foundling Hospital, Nursery and Child's Hospital, or Seaside Hospital, New York City. Grouping: Roughly 25 per cent of the subjects were classified as well nourished, 35 per cent as fairly well nourished, and 40 per cent as poorly nourished. No indication was given of the limits of the age groups or of the number of cases in each group.

STATURE (cm.) OF NEW YORK INFANTS OF THREE "NUTRITIONAL" GROUPS

Age (mos.)	Well Nourished	Fairly Well Nourished	Poorly Nourished
0.5	56.4	53.1	50.3
5.5	68.0	62.7	59.2
11.5	73.9	69.6	66.0

The ''well nourished'' infants yielded an average stature for the sixth month higher than that from the ''poorly nourished'' infants for the twelfth month. However, the implications of Fleischner's study are indeterminate. This follows since it is not known what range of conditions ''hospital patients'' encompassed, or to what extent the stature of a child entered into his classification as well, fairly well, or poorly nourished. In the latter connection, mention was made of the ''probability'' that a ''large majority'' of the poorly nourished group was ''premature.''

Francis, Carl C. **1940** Factors influencing appearance of centers of ossification during early childhood: II. A comparative study of degree of epiphysial ossification in infancy under varying conditions of diet and health. *Amer. J. Dis. Child.*, 59, 1006-1012.

Stature was studied during the first postnatal year ''under varying conditions of diet and health'' (p. 1006). Subjects: 150 viable White infants (75 of each sex) and 33 infant cadavers (16 White and 17 Negro). Measurements of ''recumbent length'' were taken on the former at ages three, six, nine, and twelve months, and on the latter at one of these ages. Parents of viable infants: Residents of Cleveland and suburbs, representing a moderately high level of socio-economic status. Diet and health groups: The subjects were selected to constitute four fairly homogeneous groups. Group I: 25 infants of each sex ''entirely or largely breast fed for three months or more'' (p. 1006). ''No child had any prolonged or severe illness . . . serious accident . . . or physical defect. Every child from an early age received vitamin supplements, usually cod liver oil, orange juice, and a cereal containing vitamin B'' (pp. 1006-7). Group II: 25 infants of each sex receiving little or no breast milk. ''These children received cod liver oil and orange juice from an early age, and . . . supplemental mineral'' (p. 1007). Group III: 25 infants of each sex having ''some difficulty in gastrointestinal adjustment'' (varying from mild eczema to pylorospasm). Most of these infants were partly breast-fed, ''vitamins were given early. When orange juice caused eczema, some other form of Vitamin C was substituted'' (p. 1007). Pediatric supervision facilitated early recognition and competent handling of the gastrointestinal difficulties. Group IV: 20 male and 13 female cadavers considered to register the results of ''serious illness or prolonged malnutrition'' (p. 1007).

STATURE (cm.) OF INFANTS OF FOUR DIETARY AND ILLNESS GROUPS

Group	3 mos.		6 mos.		9 mos.		12 mos.	
	N	Mean	N	Mean	N	Mean	N	Mean
				Males				
I	25	60.3	25	66.7	25	71.8	25	75.9
II	25	61.0	25	67.3	25	72.2	25	76.6
III	25	60.7	25	67.2	25	71.7	25	75.7
IV	8	56.8	6	63.2	1	58.8	5	68.2
				Females				
I	25	59.2	25	65.6	25	70.4	25	74.5
II	25	58.8	25	65.5	25	70.2	25	73.9
III	25	59.4	25	65.3	25	69.9	25	74.1
IV	5	56.4	4	63.9	3	60.0	1	72.0

Findings: ''the three groups of living babies . . . showed no significant variation. The dead babies were shorter'' (p. 1009).

Freeman, Rowland G. **1914** Weights and measurements of infants and children in private practice compared with institution children and school children. *Amer. J. Dis. Child.*, 8, 321-326.

The average stature of ''well-cared-for'' infants was treated. Findings for the first postnatal year were derived from data on

120 consecutive cases examined in private pediatric practice. At two years, the average was based upon an unspecified number of subjects forming part of a sample of 278 cases under thirteen years of age. All records were considered to represent infants living under fairly optimum conditions with respect to diet, rest, fresh air, exercise, and clothing.

STATURE (cm.) OF NEW YORK INFANTS EXAMINED IN PRIVATE PRACTICE

3 mos.	6 mos.	9 mos.	12 mos.	24 mos.
62.3	68.0	73.5	78.3	88.1

Freeman, Rowland G., Jr. **1933** Skeletentwicklung und wachstum im alter von 2 bis 18 monaten, von 2 bis 7½ jahren und von 8 bis 14½ jahren. *Anthropologischer Anzeiger,* 10, 185-208.

Analyses of stature data were afforded on one sample of infants between the ages of two and eighteen months and another sample at approximately two years. Subjects: 174 New York City infants —40 of each sex enrolled at the nursery school of the Institute of Child Development of Columbia University, 50 males and 44 females drawn from infant asylums and stated to represent "almost every race including negroes." The infant asylum sample was examined at two months and partially re-examined at several successive ages to eighteen months. The private nursery school sample was examined at ages varying from twenty-two to twenty-six months.

STATURE (cm.) OF NEW YORK CITY INFANTS

Age	Males				Females			
(mos.)	N	Mean	S.D.	Range	N	Mean	S.D.	Range
				Infant asylum sample				
3	50	59.2	2.52	53.0-66.5	39	58.6	2.57	51.2-63.7
6	34	65.9	3.45	56.0-74.8	43	63.9	2.40	58.8-70.1
9	19	70.5	2.40	66.2-75.0	32	68.7	2.98	60.1-73.9
12	19	74.8	2.20	70.0-79.5	20	73.4	1.75	69.8-77.0
15	8	75.0	1.60	71.6-77.0	11	74.8	3.28	68.9-79.2
18	14	80.3	2.90	74.7-84.7	10	77.6	5.06	64.2-84.6
				Private school sample				
24	40	85.6	4.33	72.1-91.4	40	84.1	4.43	73.7-92.3

Although the sample of private school children was apparently drawn from the same population as that of Wallis (1931) and probably included some of the same records, the means were lower than the Wallis means at two years by 4.3 cm. for males and 2.6 cm. for females.

Freeman, Rowland G., Jr. and **Platt,** Virginia. **1932** Skeletentwicklung und wachstum der säuglinge von der geburt bis zu einem monat. *Anthropologischer Anzeiger*, 9, 68-78.

Analyses were made of stature increments for the period from birth to one month, and of absolute stature at birth, one week, and one month. Data: Measurements of vertex-heel length obtained partly on Negro infants and partly on White infants of varied European ancestry. Subjects: 312 “normal” neonates born at the Sloane Maternity Hospital, New York City; 163 males and 149 females; 116 White males and 47 Negro; the number of White and Negro females was not indicated.

STATURE (cm.) OF NEW YORK CITY WHITE AND NEGRO INFANTS

Age	Males				Females			
(days)	N	Mean	S.D.	Range	N	Mean	S.D.	Range
1	163	49.3	1.95	43.3-55.0	149	49.0	1.89	45.2-53.8
8	75	49.8	2.14	43.8-54.0	74	49.8	2.29	44.6-56.1
30	48	53.2	2.15	47.0-59.8	56	53.4	1.93	49.8-57.8

When subgrouped by race, the sample for males at one postnatal day gave means of 49.5 cm. for the 116 Whites and 49.1 cm. for the 47 Negroes. For each of 31 males and 40 females, the centimeter and percentage gains in stature over the first month were derived. In the case of males the mean gains were 4.0 cm. and 8.2 per cent, for females they were 3.5 cm. and 7.1 per cent.

Gebhart, John C. **1924** *The growth and development of Italian children in New York City.* N. Y. Assoc. for Improving the Condition of the Poor, No. 132. Pp. 36.

Stature values derived from a sample of Italian infants between one and two years of age were reported. Subjects: 106 “apparently well” infants living in “a congested Italian district in New York City” (p. 3). Stature was taken in inches with the subjects wearing shoes, and six-tenths of an inch was deducted for the height of the shoe heel.

STATURE (cm.) OF ITALIAN INFANTS LIVING IN A CONGESTED DISTRICT

Midpoint of Age Group (mos.)	Sex	Number	Average	S.D.	V
18	Males	53	77.2	5.1	6.4
18	Females	53	77.8	7.1	9.0

The females were more variable than the males and gave a slightly larger average. Compared with the Woodbury (1921) figures for Italian infants, the averages were lower by 0.9 cm. for males and higher by 1.4 cm. for females.

Gesell, Arnold and **Thompson,** Helen. **1938** *The psychology of early growth, including norms of infant behavior and a method of genetic analysis.* New York: Macmillan. Pp. ix, 290. (See also, Thompson, Helen. 1938 Body proportions in the growing infant. *Growth,* 2, 1-12.)

This reference included an analysis of data for vertex-heel length covering the age period from two months to one year. The data were gathered between 1927 and 1931 at the Yale Clinic of Child Development, New Haven. Subjects: 107 infants, 49 males and 58 females; all full-term, from "single births," "physically normal," and healthy; 43 per cent from "first pregnancies" (pp. 28-31). "Several cases of decided malnutrition were excluded" (p. 31). Parents: American-born and of "northern European extraction" (p. 26); "of the middle socio-economic status with respect to occupation, schooling, avocational interests, and home equipment" (p. 9)—in terms of Goodenough's six occupational categories all fell in categories III, IV, or V; average age thirty years for fathers and twenty-seven years for mothers; average years of schooling 9.4 for fathers and 9.8 for mothers; "intellectual and cultural interests . . . near an average level" (p. 26). Examinations: Scheduled at four-week intervals beginning four weeks after birth; "a variation of but two days from the exact age for each examination was the rule" (p. 9); "some of the subjects were regularly and repeatedly examined, while others were seen only once" (p. 5). All measurements were taken in dorsal recumbency, those on infants between four and twelve months being "made by the same person" (Dr. Helen Thompson).

STATURE (cm.) OF NEW HAVEN "MIDDLE CLASS" INFANTS EXAMINED 1927-31

Age	Males				Females			
(wks.)	N	Mean	S.D.	Range	N	Mean	S.D.	Range
8	14	58.1	1.89	55.2-61.6	12	56.8	2.37	54.0-60.8
12	12	61.3	2.11	58.3-64.6	13	59.1	2.49	55.2-62.8
24	16	67.4	1.05	64.9-71.2	21	65.0	2.04	62.3-69.2
40	20	71.9	1.83	69.0-77.1	17	70.9	1.93	67.7-75.0
52	19	75.8	2.00	72.5-81.0	24	73.7	2.17	67.8-78.6

Mean stature at one year exceeded that at eight weeks by 17.7 cm., or 30.4 per cent, for males; by 16.9 cm., or 29.8 per cent, for females.

Goddard, Henry H. **1912** The height and weight of feeble-minded children in American institutions. *J. Nerv. Ment. Dis.*, 39, 217-235.

In this study of children in residence at various North American institutions for the feeble-minded, Goddard included stature averages derived from measurement of 10 infants.

STATURE (cm.) OF "MENTAL DEFECTIVES"

6 mos.		18 mos.			
Males		Males		Females	
Number	Average	Number	Average	Number	Average
2	66.0	6	71.1	2	78.7

The paucity of observations at these ages precluded any conclusions. At six months, the figure for the two male subjects exceeded the male average from Holt (1897) for infants unselected in intelligence by 1.2 cm. At eighteen months, the average for both sexes together (73.0 cm.) was less than from Holt by 3.0 cm.

Gordon, H. H.; **Levine,** Samuel Z.; **Deamer,** W. G. and **McNamara,** H. **1940** Respiratory metabolism in infancy and childhood. XXIII. Daily energy requirements of premature infants. *Amer. J. Dis. Child.*, 59, 1185-1202. (Also, Gordon, H. H.; Levine, S. Z.; McNamara, H.; Marples, E. and Benjamin, H. R. 1941 Respiratory metabolism in infancy and in childhood. XXIV. Daily water exchange of premature infants. *Amer. J. Dis. Child.*, 61, 524-534.)

Stature records for a small series of male infants born prematurely and measured from ten to forty-four days after birth were reported by Gordon, Levine, Deamer and McNamara (1940). The records were collected between 1937 and 1939 through the New York Hospital and the Department of Pediatrics, Cornell University Medical College. Subjects: 10 premature infants from single pregnancies, 8 White and 2 Negro, all males. At birth, the subjects weighed from 1130 gm. to 2220 gm. When measured, they weighed from 1543 gm. to 2564 gm. and were "in good health."

STATURE (cm.) OF MALE INFANTS OF LOW BIRTH WEIGHT

Weight (grams)		Postnatal age (days)		Stature		
At Birth	When measured	Midpoint	Range	Number	Mean	Range
1130-1200	1543-1578	43	41-44	2	41.3	41-41.5
1500-2030	1716-2083	16	10-25	6	44.8	42-46.0
2170-2220	2379-2564	20	17-23	2	47.3	47-47.5

Six of the 10 infants were measured from ten to eighteen days after birth, and fell within the weight limits of 1500 gm. and 2500 gm. both when measured and at birth. These cases gave a mean stature of 45.0 cm.

All 10 records were reproduced in the later paper by Gordon, Levine, McNamara, Marples and Benjamin (1941). Here, they were supplemented with data on one White male measured eight days after birth (stature 43.0 cm., weight 1602 gm.) and on one Negro male twin measured at thirty-one days (stature 46.0 cm., weight 2366 gm.).

Grandprey, Medora B. **1933** Range of variability in weight and height of children under six years of age. *Child Developm.*, 4, 26-35.

Tables of variability in stature were compiled employing the stature distributions published by Woodbury (1921) for White infants measured during the "Children's Year." The tables afforded tenth and ninetieth percentiles on each sex at selected months of age. These values were regarded as the "limits" of stature variability "inherent in normal children" (p. 35).

STATURE (cm.): VARIABILITY VALUES FOR NORMAL WHITE INFANTS EXAMINED 1918-19

Age Group		Males		Females	
Midpoint (mos.)	Range	Percentiles		Percentiles	
		10th	90th	10th	90th
1.5	1 to 2	52.8	61.2	51.3	59.7
6.5	6 to 7	63.2	71.9	62.2	70.6
12.5	12 to 13	70.1	79.2	68.3	77.2
18.5	18 to 19	75.7	86.4	74.2	84.8
24.5	24 to 25	80.0	90.4	78.7	88.9

The stature reached by less than 10 per cent of the male and female infants at age six weeks was surpassed by 90 per cent of those five months older. The stature attained by 10 per cent of each sex at age six months was exceeded by 90 per cent of those older by nine months. The stature exceeded by 10 per cent of each sex at one year was not reached by 90 per cent at any age younger than two years.

Gray, H. 1941 Individual growth-rates from birth to maturity for 15 physical traits. *Hum. Biol.*, 13, 306-333.

This paper, while primarily a discussion of the calculation of growth rates, incorporated "original absolute measurements" of stature taken on a "normal" male infant at one and two years of age.

STATURE (cm.) OF A SINGLE MALE INFANT

Size		Gain	
12 mos.	24 mos.	Absolute	Percentage
76.0	91.0	15.0	19.7

Compared with the stature distributions obtained by Meredith (1940) for males of the professional and managerial classes, the stature of this infant was equivalent to the thirty-sixth percentile at one year and the seventy-eighth percentile at two years. The change in percentile rank of more than forty points was, of course, due to the amount of gain in stature between one and two years, which was markedly higher than the increase in mean stature of 11.8 cm. (15.3 per cent) for the Meredith study.

Gray, Horace and **Ayres,** J. G. **1931** *Growth in private school children.* Chicago: Univ. Chicago Press, Pp. 282.

Stature data were analysed which the authors considered representative of "normals in private schools" aged one and two years. For roughly half of the 72 subjects, both parents and all four grandparents were born in the United States. "The socio-economic level was superior" (p. 6). Some of the records were apparently obtained through the nursery school of the Bureau of Educational Experiments, New York City.

STATURE (cm.) OF "PRIVATE SCHOOL" INFANTS

Age Group Midpoint	Range (mos.)	Number	Mean	S.D.	V
		Males			
12	6 thru 17	18	75.2	4.02	5.3
24	18 thru 29	21	89.6	3.66	4.1
		Females			
12	6 thru 17	12	75.4	4.55	6.0
24	18 thru 29	21	85.4	3.33	3.9

Supplementary means were given for the males with native-born parents and grandparents. These were 75.1 cm. for ten cases at one year and 88.7 cm. for eleven cases at two years.

Gray, Horace and **Faber,** H. K. **1940** Individual growth records of two healthy girls from birth to maturity. *Amer. J. Dis. Child.,* 59, 255-280.

Seriatim stature data on two female infants were presented. Subjects: Both of "so-called old American stock," both born in 1921, the "economic background was such as to start both toward ideal girlhood" (p. 256). Illness history: Infant A had grip at 1.2 years and Infant B tonsillitis at 1.6 years. Infant A was born in Boston. Ancestry of A: Parents and grandparents of North European descent, stature 174.0 cm. and 164.1 cm. for paternal grandparents, 181.9 cm. and 162.5 cm. for maternal grandparents, 181.9 cm. and 165.9 cm. for father and mother, respectively. Ancestry of B: Parents and grandparents of North European descent, statures 172.7 cm. and 154.9 cm. for paternal grandparents, 175.3

cm. and 157.5 cm. for maternal grandparents, 177.8 cm. and 157.5 cm. for father and mother, respectively.

STATURE (cm.) OF TWO FEMALE INFANTS MEASURED 1921-23

Subject	Birth	1 mo.	3 mos.	6 mos.	12 mos.	24 mos.
A	53.0					88.0
B	47.0	54.0	60.6	68.2	74.9	85.1

The two series of stature values tended to converge, reducing their difference from 6.0 cm. at birth to 2.9 cm. at two years. Between birth and two years, Subject A gained 35.0 cm. and Subject B 38.1 cm. These gains represented increases on stature at birth of 66.0 per cent for A and 81.1 per cent for B.

Grover, Joseph I. **1915** Some measurements of normal children, especially of the leg and arm. *Arch. Pediat.*, 32, 473-486.

Included in this reference was an analysis of 120 records for recumbent stature taken on physically normal infants ranging in age from five days following birth through twenty-five months. The records were obtained at the Children's Hospital, Harvard Medical School; the Boston Lying-in Hospital; milk stations of the Milk and Baby Hygiene Association; and in private practice.

STATURE (cm.) OF BOSTON INFANTS

Age Group		*Males*		*Females*	
Midpoint	Range (mos.)	Cases	Average	Cases	Average
3	2 thru 3	7	55.2	9	55.2
6	4 thru 7	14	64.3	11	63.6
12	10 thru 13	7	72.5	6	73.0
18	16 thru 19	7	78.6	5	78.7
24	22 thru 25	10	85.6	6	84.2

At two years, comparison with the Holt (1897) and Freeman (1914) figures showed the Grover values to be intermediate. At six months, the Holt and Grover figures were similar, and the Freeman figure four centimeters higher.

Gunstad, Borghild and **Treloar,** Alan E. **1936** The relationship between the length and weight of the newborn infant and the height and weight of the mother. *Hum. Biol.*, 8, 565-580.

Stature data on two groups of newborn infants were analysed with respect to mean magnitude, variability, and relationship to maternal stature. Material: 862 "city public hospital" cases measured at the Minneapolis General Hospital 1927-30, and 905 Minneapolis "private" cases delivered by Dr. F. L. Adair during an unspecified period. Both series of records were for uniparous births in which the infant survived delivery and the mother survived the period of hospitalization. There was no selection in terms of "stage of maturity" owing to the "rather empirical nature of the decision as to whether a child was premature, normal, or post term" (p. 567). The mothers were measured at the time of discharge from the hospital.

STATURE (cm.) OF MINNEAPOLIS CITY HOSPITAL AND PRIVATE PRACTICE NEONATES

Group	Number		Mean		S.D.		Correlation with maternal stature	
	Males	Females	Males	Females	Males	Females	Males	Females
Private	447	458	50.9	50.1	2.95	3.58	.12	.15
Non-private	435	427	50.9	49.8	2.64	2.52	.14	.20

The two series did not "differ significantly in mean length" (p. 572). The private cases were "more variable" than those for the city public hospital. There was "a real and positive correlation between the length of infants at birth and the stature of their mothers . . . of the order of +.15" (pp. 574-5).

Haas, Sidney V. **1924** The value of the banana in the treatment of celiac disease. *Amer. J. Dis. Child.*, 28, 421-437.

Measurements of stature were reported on three infants treated for celiac disease during their second postnatal year. Celiac disease was stated to be generally considered "a nutritional disturbance of late infancy and early childhood, due to inability to utilize fats and carbohydrates in a normal manner" (p. 436). Haas' special interest was to study tolerance for carbohydrates in the form of ripe bananas. Subjects: Infant A, female, treated from one year of age to two years, symptoms at beginning of treatment were "slight edema . . . markedly distended abdomen . . . marked photophobia . . . tenderness on handling . . . loss of power in the extremities" (p. 433); Infant B, male, treated between thirteen months and two years, initial symptoms were "diarrhea . . . marked irritability . . . slight edema . . . tenderness of handling . . . distended abdomen" (p. 433); Infant C, female treated from seventeen months to two years "symptoms when first seen were diarrhea, vomiting, edema, protuberant abdomen, hyperesthesia, photophobia and marked irritability" (p. 428). Diet: The basal diet prescribed consisted of "protein milk . . . pot cheese, broth, gelatin, banana, orange, and scraped meat" (p. 428). By twenty months of age the daily diet of Infant C consisted of forty-eight ounces of albumin milk, five bananas, whites of two eggs, one orange, eight ounces of gelatin, three tablespoonfuls of minced meat, and one tablespoonful of spinach, peas, or beans. At two years, Infant B was receiving six bananas in addition to meat, broth, white of eggs, vegetables, bread and butter.

STATURE (cm.) OF THREE INFANTS UNDER TREATMENT FOR CELIAC DISEASE

Subject	12 mos.	18 mos.	24 mos.
A	67.0	71.0	81.0
B		74.0	81.0
C		74.0	80.5

From treatment of these and several older cases, Haas concluded: "Carbohydrates in the form of ripe bananas appears to be tolerated perfectly, making it possible to bring about a clinical cure in practically all cases. Whether there is a factor in the banana other than the carbohydrate content which results in the cure is unknown. (pp. 436-7).

Haas, Sidney V. **1931** Powdered ripe banana in infant feeding. *Arch. Pediat.*, 48, 248-252.

The relationship between rate of growth in stature during the first postnatal year and the use of powdered ripe bananas in place of other carbohydrate was studied. Subjects: An experimental series consisting of 41 "consecutive cases taken from private practice" and a control series of 34 infants. Diet: The two series were similarly fed except that the former "received banana powder . . . in their formula," while the latter "received some form of carbohydrate other than banana" (p. 250). The powder (manufactured by the Northjohn Corporation, New Jersey) was stated to be equivalent to whole ripe banana minus water. Subgroups: Both the experimental and control series were distributed into four age groups. Eighteen subjects were used in each of two age groups. Experimental period: The duration of the experimental period was not discussed; it may have varied from one week for some cases to three months for others.

STATURE (cm.): AVERAGE WEEKLY GAIN FOR TWO DIETARY GROUPS

	Ripe Banana Powder Series			*Control Series*		
Age Group (mos.)	Number	Average Age (mos.)	Average Gain	Number	Average Age (mos.)	Average Gain
0 to 3	14	1.5	.85	16	1.6	.64
3 to 6	15	4.0	.67	15	4.0	.44
6 to 9	11	6.5	.43	11	6.6	.41
9 to 12	6	9.5	.29	6	9.3	.28

Compared with the control series, the infants fed powdered ripe banana showed "a marked acceleration of growth in length during the first six months" (p. 252). The negligible differences between the two groups after six months was considered "probably due to the fact that by this time general foods were in the diet of the controls" (p. 250).

Hall, (Mrs.) Winfield S. **1896** The first 500 days of a child's life. The *Child-Study Monthly,* 2, 330-342.

Incorporated in this reference were values obtained from frequent measurement of the recumbent length of a single male infant over the first eighteen months of postnatal life. Parents: Professional socio-economic group; father "purely American," mother "purely English." Subject: "physically perfect" at birth; lived in Switzerland until six months of age, in Illinois after ten months; "except for an attack of whooping-cough, in a state of constant good health . . . In the open air from one to three hours every dry day, even in the coldest weather" (pp. 331-2).

STATURE (cm.) OF HEALTHY MALE INFANT OF PROFESSIONAL CLASSES

1 mo.	3 mos.	6 mos.	9 mos.	12 mos.	15 mos.	18 mos.
51.5	60.5	67.1	72.0	74.5	77.5	83.0

At eighteen months, stature "horizontal was 83 cm." and "erect was 81.5 cm." (p. 337).

Hamil, Brenton M.; **Reynolds,** Lawrence; **Poole,** Marsh W. and **Macy,** Icie G. **1938** Mineral vitamin C requirements of artificially fed infants: A study of four hundred and twenty-seven children under a controlled dietary regimen. *Amer. J. Dis. Child.*, 56, 561-583.

A graph of average stature was presented for the age period one month to one year. The basic data were obtained from over 4000 examinations on 427 healthy, Detroit infants studied 1933-36 "through the resources of the Children's Fund of Michigan and the Children's Hospital of Michigan" (p. 561). Subjects: Infants of "indigent or near-indigent parents" living under home conditions; age at first examination between two weeks and three months; 80 per cent followed over "a period of nine months or more" (p. 566). Diet: The basal formula was "a mixture of evaporated milk, water and corn syrup . . . acidified by the addition of commercial dehydrated lemon juice of known ascorbic acid content" (pp. 567-8); after three months of age the daily dietary was maintained at 399 cc. evaporated milk, 1970-2050 International units of vitamin C, 150-250 Sherman-Chase units of vitamin B_1, 0-810 U.S.P. units of vitamin D (111 cases received 675-810 units, 181 cases 250-600 units and 133 less than 165 units); 35 per cent of the subjects were given strained vegetable soup. The dietary regimen was "as rigidly controlled as possible"—visiting nurses "kept the mothers supplied with the essential materials for the formulas and supervised the care of the infants" (p. 567).

STATURE (cm.) OF DETROIT INFANTS OF LOWER CLASSES UNDER DIETARY SUPERVISION

1 mo.		3 mos.		6 mos.		9 mos.		12 mos.	
Cases	Mean	Cases	Mean	Cases	Mean	Cases	Mean	Cases	Mean
231	53.9	393	60.2	374	66.6	328	71.7	254	75.6

On the basis of "minute roentgen changes," 21 of the 427 infants were diagnosed as having "mild" or "preclinical" scurvy. Comparison of the stature curves for the total series and the scurvy subgroup was stated to yield "a slight difference" in favor of the former. "Twelve of the 21 infants showed slowing rate of growth in length before scurvy was evident . . . 18 showed slowing or cessation of gain at the time scurvy was manifest" (p. 575). All infants recovered spontaneously and "resumed the normal rate of gain after disappearance of the roentgen signs of scurvy" (p. 576). The authors concluded, "it would appear that slight slowing in rate of gain in height is suggestive of developing scurvy" (p. 576).

Harris, J. Arthur. **1926** I. On correlation between age of parents and length and weight of the newborn infant. II. Relationship between pregnancy order and birth order and length and weight of newborn infants. *Proc. Soc. exp. Biol. and Med.*, 23, 801-808.

Relationships were investigated between stature at birth and the variables age of parents, number of pregnancy, and order of birth. Data: Selected from among "44,000 records" amassed at the Sloane Hospital for Women, New York City, during the thirty-year period 1890 to 1921. Records were apparently accepted for tabulation provided both parents were of White stock and were born in one of a specified group of European countries. Subjects: 4509 White infants—approximately 2300 males and 2200 females—of foreign-born parentage. Parents: Both born in Ireland, 49 per cent; in Germany, 19 per cent; in Russia, 14 per cent; in Great Britain, 7 per cent; in Austria, 6 per cent; and in Italy, 5 per cent.

STATURE AT BIRTH IN RELATION TO PARENTAL AGE, PREGNANCY AND BIRTH ORDER

	Pearson Product-Moment Coefficient	
	Male infants	Female infants
Age of mother	.095	.025
Age of father	.083	−.019
Pregnancy order	.091	−.012
Birth order	.090	−.005

All associations were "very low." For the one sex (males), the r's were all sufficiently large to indicate a definite (statistically significant of the 1 per cent level of confidence) though "very low'' degree of positive relationship. (It is shown in the section of Part I on ''Differences with parity, age and stature of mother,'' that the findings for females of complete absence of positive relationship between stature and number of pregnancy, and between stature and order of birth, do not harmonize with comparable findings from other studies.)

Hess, Alfred F. **1916** Infantile scurvy: III. Its influence on growth (length and weight). *Amer. J. Dis. Child.*, 12, 152-165. (Also, see abstract in *Proc. Soc. exp. Biol. and Med.*, 1915-16, 8, 50-52.)

Study was made of stature in relation to subacute scurvy—scurvy considered to be produced through the elimination of orange juice from the infant's diet and eradicated by supplementing the diet with orange juice. Apparently an unspecified number of ''cases of scurvy arose in an institution where the use of orange juice was discontinued,'' leading to the view that pasteurized milk ''gradually induces infantile scurvy, unless anti-scorbutic diet is given in addition'' (p. 152).

Stature curves were presented for two infants showing how each grew on a basic diet of pasteurized milk, sugar, and cereal over months ''when they were receiving orange juice, when the orange juice was discontinued, and when this juice or the juice of the orange peel was again added to the diet'' (p. 153). One infant, observed from seven to eighteen months of age, gained over 4.0 cm. during the initial two months on orange juice, 4.0 cm. during the following six months in which no orange juice was given, and over 4.0 cm. during three months after orange juice was again a part of the diet. The other infant, observed from ten to twenty-one months, gained slightly more than 2.5 cm. during the initial two months on orange juice, 4.0 cm. during the next half year, and, with the resumption of orange juice, over 4.0 cm. the following quarter year. It was concluded that growth in stature was ''retarded during the protracted development of infantile scurvy,'' while ''super-growth followed the addition of the essential foodstuff'' (p. 165).

Hess incorporated a stature trend derived from repeated measurement of ''10 normal infants'' fed continuously on a diet of pasteurized milk, sugar, cereal, and orange juice. The subjects were seemingly in residence at the Hebrew Infant Asylum, New York City, around 1915.

STATURE (cm.) OF TEN HEALTHY INFANTS EXAMINED AT SUCCESSIVE AGES

6 mos.	12 mos.	18 mos.
66.7	73.1	78.3

On alignment of these figures with those of Crum (1916), the values were found to be practically equivalent at six months and progressively divergent at later ages—the Hess average being the lower at eighteen months by 1.5 cm.

Holt, Luther Emmett. **1897** *The diseases of infancy and childhood.* New York: D. Appleton. Pp. 1117. (Growth and development of the body. Ch. 2, pp. 15-24).

Stature means were presented for each sex at birth and at semiannual intervals to two years. The birth values were determined from 442 records for full-term infants accumulated at the New York Infant Asylum and Sloane Maternity Hospital. The number of observations employed at older ages was not indicated: Probably these data were collected in private practice. No specific discussion was given of the socio-economic or ethnic characteristics of the total sample or of the new-born series.

STATURE (cm.) OF NEW YORK INFANTS

Age	*Males*		*Females*	
(mos.)	Number	Mean	Number	Mean
Birth	231	52.5	211	52.2
6	...	64.8	...	63.6
12	...	73.8	...	73.2
18	...	76.3	...	75.6
24	...	82.8	...	82.8

For each sex, average stature at two years exceeded stature at birth by slightly over thirty centimeters. The increase during the first year was more than double that during the second.

Holt, Luther Emmett and **Howland,** John **1919** *The diseases of infancy and childhood.* (7th edition). New York: D. Appleton. Pp. 1034. (Also 9th edition, 1926, Pp. 1018).

The figures published by Holt (1897) at semiannual ages from six months to two years were revised by Holt and Howland (1919). The revision sample, like the original, was not described as to size or selection. Data: Probably accumulated in private pediatric practice, possibly collected partly in New York and partly in Baltimore.

STATURE (cm.) OF MALE AND FEMALE INFANTS

Age	*Males*		*Females*	
(mos.)	1897	1919	1897	1919
6	64.8	67.3	63.6	66.0
12	73.8	75.0	73.2	73.7
18	76.3	81.2	75.6	79.8
24	82.8	86.3	82.8	84.8

The 1919 values *exceeded* those reported in 1897 by 0.5 cm. to 4.9 cm., with an average increase of 2.7 cm. Holt and Howland wrote: "It is our observation and we think that of most pediatrists in the United States that the generation born since 1900 is . . . taller . . . than the previous one; this is certainly true of the children of parents born in this country" (p. 19).

In this connection, it is pertinent to refer to a third series of averages for "healthy" infants, published by Holt and Howland in 1926. The only differences from the 1919 figures were at eighteen and twenty-four months. At each of these ages the 1926 averages were *lowered* by 1.2 cm. for males and 1.0 cm. for females.

Hoobler, B. Raymond. **1931** Use of vitamin B in diets of infants. *J. Amer. Med. Assoc.*, 96, 675-677.

Study was made of the relation between gain in stature and the addition of vitamin B complex to the diet. Data: Collected over a period of five months "in the nursery wards of the Florence Crittenton Hospital, Detroit, in the service of Dr. Edgar Martmer" (p. 676). Subgroups: Unspecified numbers from "approximately 125 infants" constituted a breast-fed group and two groups fed artificially. Diets: No discussion for the breast-fed group; the basal ration given the other groups was "whole milk dilutions" plus a "preparation of maltose and dextrin" (Mead's Dextri-Maltose No. 2). One of the artificially fed groups received additions of vitamin B complex "in the form of the extract of wheat germ and the extract of brewer's yeast . . . added at the rate of 1 Gm. of wheat germ and 0.5 Gm. of brewer's yeast extract to each ounce of the preparation of maltose and dextrin used" (p. 676). Procedure: The two artificially fed groups received the basal ration for a two-week preliminary period; following this they were measured, fed the experimental diets for one month, and remeasured.

AVERAGE MONTHLY GAIN IN STATURE (cm.) FOR THREE DIETARY GROUPS

Breast fed Group	Maltose and dextrin group	Maltose and dextrin plus vitamin B group
2.46	2.08	2.31

Summarizing the relationships between these average gains "during a twenty-eight day period," Hoobler wrote: "Breast-fed infants grew most; those fed with the maltose and dextrin preparation with vitamin B additions were a close second, while those given the maltose and dextrin preparation only showed considerably less growth" (pp. 676-7).

Hrdlicka, Ales. **1908** *Physiological and medical observations among the Indians of southwestern United States and northern Mexico.* Bur. Amer. Ethnology, Bul. 34. Washington: Gov't. Printing Office. Pp. 460.

Measurements of stature were obtained during the second year of postnatal life on nine American Indian infants of the Pima and Apache tribes of Arizona. Subjects: 3 males and 6 females, all "full-bloods" (p. 7). Diet: Stated as customary practice among these tribes for infants to be at least partly breast-fed until after two years of age. Supplementary statements were: a) "For the first five or six months the Apache baby gets only mother's milk; later on it receives a little food of any kind eaten by the mother" (p. 76), and b) the Pima infant, "in addition to being nursed" is sometimes fed "on fruit and other things from the time it is about four or five months old" (p. 78). The data were collected between 1898 and 1905.

STATURE (cm.) OF FULL-BLOOD INDIAN INFANTS OF PIMA AND APACHE TRIBES

Age	*Males*		Age	*Females*
(mos.)	Apache	Pima	(mos.)	Pima
12.4	72.0		12.5	70.6
20		77.2	17.5	77.0
24		75.5	18	72.5
			22	74.8
			22	75.2
			23	79.7

Compared with the average trends for White infants from Holt (1897) these values were found to be lower by 2.0 cm. for the Apache male aged 12.4 months, by 3.1 cm. for the Pima female aged 12.5 months, by 7.3 cm. for the Pima male aged twenty-four months and by 1.8 cm. for the Pima female aged twenty-three months.

Hrdlicka, Ales. **1941** Height and weight in Eskimo children. *Amer. J. phys. Anthrop.*, 28, 331-341.

Measurements of stature taken on six Eskimo infants were reported. The data were collected between 1928 and 1931 in "the Kuskokwin region," Alaska. Records for "known misbreeds were not included" (p. 331). The infants "lived in their homes, under semicivilized and slowly improving conditions" (p. 331).

STATURE (cm.) OF SIX ESKIMO INFANTS

Age (mos.)	*Males*		*Females*
12			56.5
18	73.7		
22			86.4
24	80.6	83.8	68.6

The paucity of cases necessitated that the results be regarded "merely as indications" (p. 336). Notwithstanding, it may be noted that the four infants at or near the age of two years gave a mean (79.9 cm.) smaller than that from any study of White infants reviewed. For the two males at age two years, the mean (82.2 cm.) was identical with that on Italian infants from Woodbury (1921) and lower than all other means for White infants.

Iowa Child Welfare Research Station. 1931 Physical traits of Iowa infants. *Amer. J. Dis. Child.*, 42, 1137-1143.

Records of "total length" covering the age period from two weeks to twenty-four and one-half months—965 for males and 710 for females—were analysed. Subjects: "Iowa infants," probably residents of east-central Iowa, not described with reference to socio-economic selection. Each case was measured by two anthropometrists. Data: Apparently collected during the early 1920's at one-day clinics "held in various towns and cities in the state" and following 1925 through a permanent clinic at Iowa City.

STATURE (cm.) OF IOWA INFANTS

Age Group		*Males*				*Females*			
Midpoint	Range (mos.)	Cases	Mean	S.D.	V	Cases	Mean	S.D.	V
1	0.5- 1.5	17	54.7	2.25	4.1	16	52.4	2.51	4.8
3	2.5- 3.5	26	61.6	3.42	5.6	8	59.9	---	--
6	5.5- 6.5	48	67.8	3.39	5.0	32	65.4	2.33	3.6
9	8.5- 9.5	53	71.7	2.76	3.8	41	71.1	3.51	4.9
12	11.5-12.5	57	75.2	3.18	4.2	41	73.9	2.55	3.4
15	14.5-15.5	36	78.6	2.71	3.4	29	76.5	2.50	3.3
18	17.5-18.5	42	81.9	2.81	3.4	30	79.8	3.61	4.5
24	23.5-24.5	30	86.5	3.56	4.1	35	85.3	3.80	4.4

Compared with the means reported by Woodbury (1921) for Iowa infants examined in 1918, these means were higher by upwards of one centimeter at all ages from nine months to two years.

Ito, Paul K. **1936** Anthropometric study of new-born infants of Japanese parents in America. *Amer. J. Dis. Child.*, 52, 321-330.

Measurements of vertex-heel length were obtained on 202 full-term infants of Japanese parentage born 1932-35 in Los Angeles, California. Parents: About one-fifth American-born. Mothers: Approximately 56 per cent primiparae, average 25.2 years. Fathers: "laborers, farmers, horticulturists, clerks, small merchants, public officials and professional men. The majority were of the laboring class but were comparatively well-to-do for Japanese in California" (p. 321).

STATURE (cm.) OF NEONATES OF JAPANESE ANCESTRY AND "BELOW AVERAGE" CLASSES

Age Group		*Males*			*Females*		
Midpoint	Range (days)	Cases	Mean	Range	Cases	Mean	Range
4	0-7	94	50.0	44.5-55.0	108	49.7	44.5-54.0

Compared with means from samples of American-born White infants, Ito's means for American-born infants of Japanese descent were above those of Stockton-Hough (1885), Riggs (1904) and Freeman and Platt (1932), but below those of Holt (1897), Montague and Hollingworth (1914), Bakwin and Bakwin (1934) and others (See Tables Ia and Ib of the appendix).

Jeans, Philip C. and **Stearns,** Genevieve (with the technical assistance of Eva A. Goff, John B. McKinley and Martha J. Oelke). **1933** Growth and retentions of calcium, phosphorus and nitrogen of infants fed evaporated milk. *Amer. J. Dis. Child.*, 46, 69-89.

This reference treated stature measurements obtained during 1930 on a small group of infants housed in the metabolism ward, Department of Pediatrics, University Hospitals, Iowa City. Subjects: "nine healthy male infants" fed a controlled diet from the first postnatal month "for periods lasting from eighteen to forty-eight weeks" (p. 69). Diet: "a mixture of equal parts of evaporated milk and 12 per cent corn syrup, acidified with lactic acid" (p. 88.) "This mixture was intended to be approximately equivalent to undiluted acidified fresh milk with the addition of 6 per cent corn syrup" (p. 69). "One teaspoonful of cod liver oil was given daily to infants of all ages, 1 ounce (28.35 cc.) of orange juice daily to infants under 4 months of age and 2 ounces (56.7 cc.) to older infants; an egg yolk was added to the daily diet at 4 months of age, sieved vegetables at 5 months and sieved fruits at 6 months" (p. 70). Illness: The authors mentioned "the occurrence of a severe infection of the upper respiratory tract, which affected to a greater or lesser degree six of the infants" (p. 71).

STATURE (cm.) OF IOWA CITY MALE INFANTS ON CONTROLLED DIET FROM FIRST MONTH

3 mos.		6 mos.		9 mos.	
Number	Mean	Number	Mean	Number	Mean
9	61.4	6	68.4	6	73.0

The means for Iowa male infants published by Woodbury (1921) and by the Iowa Child Welfare Research Station (1931) were slightly higher at three months, lower at six months by 0.9 cm. and 0.6 cm. respectively, and lower at nine months by 1.7 cm. and 1.3 cm. respectively. Jeans and Stearns concluded that under the conditions of diet and health care they employed "growth in length . . . was excellent" (p. 89).

Jeans, Philip C. and **Stearns,** Genevieve (with the technical assistance of John B. McKinley, Eva A. Goff and Dorothy Stinger. **1936** Factors possibly influencing the retention of calcium, phosphorus, and nitrogen by infants given whole milk feedings. I. The curding agent. *J. Pediat.,* 8, 403-414.

Stature findings were reported for 22 male infants fed milk mixtures which formed a fine, readily digestible curd in the stomach. The subjects were housed in the metabolism ward, Department of Pediatrics, University Hospitals, Iowa City, during the years 1930-33. They were observed over periods of varying length between the age limits of five and forty-five weeks. "Ten infants were given whole or evaporated milk feedings acidified with lactic or citric acid; for eight infants the milk was curded by the addition of a pepsin-rennin preparation; and four infants were fed unacidified evaporated milk mixtures" (p. 414). "The feedings of each type contained 6 per cent of added carbohydrate, consisting of a dextrin-maltose mixture. Each infant received one teaspoonful of cod liver oil daily, containing approximately 350 U.S.P. units of vitamin D . . . 1 ounce of orange juice was given daily to infants under four months of age, 2 ounces to older infants; an egg yolk was added to the feeding at four months, sieved vegetables were given at five months, and sieved fruits at six months" (p. 404).

STATURE (cm.) OF IOWA CITY MALE INFANTS UNDER CONTROLLED DIETS

3 mos.		6 mos.		9 mos.	
Number	Mean	Number	Mean	Number	Mean
12	59.9	8	68.6	3	75.0

that the clinic infants were probably under six months of age when accepted for study. This follows since their "diets were started when only milk and carbohydrate were being given" (p. 538). In the absence of explicit information on the extent to which the groups were equated, the stature gains cannot be dependably evaluated. As supporting material here, the Bayley and Davis (1935) study showed average stature gains of upwards of twenty-five centimeters from birth to one year of age and of less than nineteen centimeters between the ages of three and fifteen months. With reference to Joslin and Helms' orphanage series, at the beginning of the two-month experimental period the average stature of the control group (81.9 cm.) exceeded that of the "Cerevim" group by 5.7 cm.

King, Irving. **1910** Measurements of the physical growth of two children. *J. Educ. Psychol.*, 1, 279-286.

Utilizing "regular measurements of two brothers," King reported on their growth in stature during infancy. One boy was born in 1903, the other in 1906. Both were "apparently normal in all respects and . . . at no time had serious or protracted sickness. Their only ailments were occasional light colds and equally light attacks of measles" (p. 280). Family: Grandparents and parents American-born, father a university professor. Stature was carefully determined. The data were accumulated during the years 1903 to 1908, partly while in residence at Ann Arbor, Michigan, and partly after moving to Iowa City, Iowa.

STATURE (cm.) OF TWO BROTHERS

Subject	Birth	1 mo.	6 mos.	12 mos.	18 mos.	24 mos.
A	52.1	56.6	70.1	80.3	88.0	90.7
B		57.2	69.9	78.2	85.9	88.6

The boys were similar in stature at the age of six months, but throughout the second year A was taller than B by about two centimeters. Between the ages of one month and one year, A gained 23.7 cm., or 42 per cent, and B, 21.0 cm., or 37 per cent; between one and two years, each boy gained 10.4 cm., or approximately 13 per cent.

Lane, Dorothy E. **1931** The nutrition of twins on a vegetable diet during pregnancy, the nursing period and infancy. *Amer. J. Dis. Child.*, 42, 1384-1400.

Stature measurements were presented at age two years for a single pair of fraternal twins fed "a balanced diet of vegetable foods" (p. 1184). The experiment was an outgrowth of previous clinical experience suggesting that "a vegetable diet, well balanced in the various minerals and vitamins, low in protein and fat, and comparatively high in carbohydrate, was entirely adequate for pregnancy, lactation and growth" (p. 1187). Mother: The mother adhered to an "almost strictly vegetable diet" throughout pregnancy and lactation. The foods emphasized were peas, beans, lentils, peanuts, whole wheat, bran, almonds, figs, orange juice, bananas, tomatoes, green lettuce and cabbage, raw celery and carrots, cauliflower, and potatoes. The animal foods used were "a small square of butter a day, occasionally a little cream, an egg . . . a small serving of meat once a week . . . a teaspoonful of cod liver oil with each meal" (p. 1390). "Special attention was directed to the ratio of calcium and phosphorous, to the amount of iron, iodine and copper, to a high vitamin content" (p. 1390). Subjects: Normal, healthy, full-term twins, born 1928, the male weighing 2976 gm. and the female 2835 gm. During the early weeks of postnatal life the infants received breast milk supplemented with cow's milk, lactic acid, orange juice and cod liver oil. Gradually, a vegetable milk closely resembling human milk was introduced. This was developed mainly from almond flour, whole wheat flour, corn starch, peanut flour, soy bean flour, dextrimaltose and vegetable water. "At the end of the third month, the vegetable milk had entirely replaced the supplementary cow's milk feedings, and after the fifth month it was the only milk used" (p. 1391). At eight months a variety of pureed, ground or grated vegetables and fruits were added to the diet; at eighteen months "all the fresh fruits were given, including the berries" (p. 1394). The infants never tasted meat, butter, cream or eggs and had no cow's milk after their third month.

STATURE (cm.) OF FRATERNAL TWINS FED AN ALMOST STRICTLY VEGETABLE DIET

Age	Male	Female
24 mos.	85.4	85.1

Conclusions: "All of the infants grew in length . . . at somewhat greater rates than the average standards. No differences in rate of growth could be ascribed to the different diets" (p. 406).

Jeans, Philip C. and **Stearns,** Genevieve. **1938** The effect of vitamin D on linear growth in infancy: II. The effect of intakes above 1,800 U.S.P. units daily. J. Pediat., 13, 730-740. (See also, Boyd, Julian D. 1941 Clinical appraisement of growth in children. *J. Pediat.*, 18, 295-298).

Utilizing infants "living under carefully controlled conditions of housing and diet" during portions of the first postnatal year, study was made of the relationship of vitamin D intake and of illness to rate of growth in stature. Vitamin D experiment: Nine infants were given 1800-4600 U.S.P. units of vitamin D supplement daily from three sources. Specifically, one male and one female received three teaspoonfuls of cod liver oil daily (which allowed an intake of about 1800 units of vitamin D and 6300 units of vitamin A) from the first month to four and eight months respectively; one male and two females received 3 cc. of cod liver oil concentrate emulsified in cream and dispersed in milk (permitting a daily intake of 2200 units of vitamin D and 1400 units of vitamin A) from the first month to seven months (male) and to four and five months (females); one male and three females received viosterol in oil (allowing about 4500 units of vitamin D daily but no additional vitamin A) from the first month to eight months (male) and nine months (female), from the third month to five months (female), and from the sixth month to ten months (prior to the sixth month, this female had received a vitamin D intake of 270 units daily as viosterol).

STATURE (cm.) OF INFANTS GIVEN 1800-4600 UNITS VITAMIN D DAILY FROM FIRST MONTH

	Size						*Gain*			
	1 mo.		3 mos.		6 mos.		1 to 6 mos.		3 to 6 mos.	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Males	3	53.6	3	61.0	2	68.0	2	14.5	2	7.1
Females	4	53.6	4	60.4	2	66.0	2	14.3	2	7.3
Total	7	53.6	7	60.7	4	67.0	4	14.4	4	7.2

Without overlooking the instability of stature means derived from such few cases, it may be noted that the mean for males at six months (68.0 cm.) was practically identical with that reported by Stearns, Jeans and Vandecar (1936) at six months for male infants "given the equivalent of one teaspoonful of cod liver oil daily (340 to 400 U.S.P. units of vitamin D)."

In the opinion of Jeans and Stearns, the mean gain of 7.2 cm. between three and six months should be considered the most crucial value of the above tabulation for indicating the effect of large amounts of vitamin D on stature. They presented sample curves illustrating "an apparent lack of relationship between the rate of growth during the first six to eight weeks of infancy and the dietary regimen given the infant" (p. 732). While "unable to state exactly the cause of these differing rates of growth during the first two months," they recommended that only stature changes after two months be regarded as "indicative of the effect of diet" (p. 733).

At various ages between four and ten months, five of the infants were found to show practically no gain in stature over a period of two weeks to one month. All were placed on a smaller daily intake of vitamin D (400-600 U.S.P. units) and followed for a period of six weeks or longer. Since in each instance the rate of growth in stature increased appreciably, the investigators concluded: "The effect of vitamin D on linear growth apparently reaches a maximum and further increases in intake result in decreased, rather than increased rates of growth" (p. 739).

On the effect of illness, six individual curves were presented. These indicated a "slowing" or "cessation of linear growth" of two to six weeks duration in relation to pneumonia at two months, acute bronchitis at four months, "bronchitis followed by mild middle ear infection" at five months, acute bronchitis at six months, "acute laryngitis requiring tracheotomy" at seven months, otitis media at eight months. The curves carried one or two additional instances of otitis media and bronchitis which, to the annotator, appeared not to be associated with a reduced rate of growth in stature. Notwithstanding, Jeans and Stearns stated: "In our experience, illness seems always to cause a slowing of growth, but the retardation may be of short or long duration, may occur during the illness, or after the infant has recovered (p. 731). They added: "This period of slower growth is usually followed by a period of more rapid growth, which usually compensates entirely for the earlier slowing." (p. 731).

John, Henry J. **1935** Growth of diabetic children. *Amer. J. Digest. Dis. and Nutr.*, 1, 855-857.

Included in this study of 100 diabetic children, were measurements of stature for a single infant at age one year and for five infants at two years. The subjects were probably residents of Cleveland.

STATURE (cm.) OF DIABETIC INFANTS

12 mos.		24 mos.		
Number	Record	Number	Mean	Range
1	64.5	5	83.9	71.5-92.5

The figures for this small series neither supported the view that diabetes was associated with excessive tallness, nor indicated that "at the time when diabetes first developed, the child almost without exception, was above the normal average in his height" (p. 856). On the contrary, the mean of 83.9 cm. at two years was two to four centimeters lower than several of the means for non-diabetic infants representing the same decade of research (see Table IXa of the appendix).

Johnson, Buford J. **1925** *Mental growth of children in relation to rate of growth in bodily development.* New York: E. P. Dutton. Pp. 160.

Stature records were presented for 12 infants aged two years, enrolled between 1919 and 1923 at the Nursery School of the Bureau of Educational Experiments, New York City. The subjects were primarily of American-born parentage and from homes somewhat above average in socio-economic status.

STATURE (cm.) OF NEW YORK CITY INFANTS FROM "ABOVE AVERAGE" HOMES

	Males			*Females*		
Age	Number	Mean	Range	Number	Mean	Range
24 mos.	5	89.6	85.1-93.5	7	87.3	84.6-91.9

Without overlooking the limited size of these samples, it may be noted that none of the other studies annotated for the period prior to 1930 yielded larger means at this age (see Table IXb of the appendix.)

Joslin, C. Loring and **Helms,** Samuel T. **1937** The vitamin B complex: A clinical and experimental study with special reference to growth and constipation. *Arch. Pediat.*, 54, 533-547.

The association between increase in infant stature and the addition of vitamin B complex to the diet was investigated. Subjects: 100 infants followed "over a period of one year" through the pediatric clinic, University of Maryland, Baltimore, and 20 orphanage infants studied "for two months" (pp. 534, 540). Clinic subgroups: The 100 clinic infants were "placed alternately in two groups"; both groups were "given the same basic diet, consisting of milk, water and carbohydrate, varied only as their ages demanded, with the addition of cereal and vegetables after six months of age" (p. 534); their diets differed only in that one group was given a mixture of carbohydrate with vitamin B complex (dextrimaltose with vitamin B), while the other received "carbohydrate without additional vitamin B" (p. 535). Orphanage subgroups: The 20 orphanage infants were similarly "divided into two groups" and fed like diets except that one group received a special cereal mixture rich in vitamin B complex (Cerevim), while the other was given non-reinforced cream of wheat and oatmeal cereal.

STATURE GAIN OF INFANTS IN RELATION TO VITAMIN B COMPLEX

Vitamin B Group		Control Group		Vitamin B gain minus Control gain
Number	Average	Number	Average	
Centimeter gain over one year for clinic series				
50	25.8	50	19.5	6.3
Centimeter gain over two months for orphanage series				
10	3.8	10	2.5	1.3

Growth in body length during infancy was apparently facilitated with "administration of an additional amount of vitamin B complex through special carbohydrate in the diet" and with "addition of vitamin B complex to the diet in the form of a special cereal mixture" (p. 546). Comment: Joslin and Helms did not state whether each pair of subgroups was matched for age. The clinic series, for instance, was stated to have been followed for a year, but the year was not designated as extending from birth to twelve months of age. No more precise inference appears warranted than

Following examination of the infants at two years of age, Dr. Joseph Brennemann stated: "They are both as active, and in as good a state of nutrition as any children that I have ever seen. They are very solid . . . and present no slightest clinical evidence of present or past rickets . . . The anterior fontanelles are closed. The teeth are normal and of good quality. They have never had any sickness except three slight colds . . ." (p. 1398).

Law, John L. and **Frederick,** W. G. **1938** Insensible loss of weight in infancy. *Amer. J. Dis. Child.*, 55, 966-978.

Stature data were presented for 45 full-term infants varying in age "between 8 days and 10½ months" (p. 967). The subjects, 24 males and 21 females, were all "free from acute infections." The majority were babies hospitalized for minor orthopedic corrections or for oral conditions requiring surgical intervention and were in good health" (p. 967). Stature was taken "with an accurate measuring board" (p. 968).

STATURE (cm.) OF WELL INFANTS HAVING MINOR PHYSICAL DEFECTS

Age Group				
Midpoint (mos.)	Range (wks.)	Number	Mean	Range
1	1 to 7	16	53.3	48.4-58.3
3	9 to 17	10	58.5	53.7-64.3
6	20 to 32	11	64.9	54.2-71.6
9	33 to 45	8	71.2	66.5-73.5

A graph showed each subject plotted for stature (abscissa) and for a measurement of "basal insensible perspiration" (ordinate). The graph was described as registering a rise in the basal insensible loss "proportional to the increase in body stature," with a tendency for the curve of the plotted points to be "slightly paraboloid in the lower third of the statural group" (p. 977).

Levine, Samuel Z.; **Wilson,** James R. and **Gottschall,** Gertrude. **1928** The respiratory metabolism in infancy and childhood: VIII. The respiratory exchange in marasmus. *Amer. J. Dis. Child.*, 35, 615-630.

Measurements of stature were obtained on five marantic infants.

Subjects: Available for study at the Department of Pediatrics, Cornell University Medical College, and the Nursery and Child's Hospital, New York City; "all markedly emaciated, being in every instance 47 per cent or more underweight" (p. 619).

STATURE (cm.) OF FIVE MARANTIC INFANTS

Age (mos.)	Sex	Stature	Amount less than interpolated average from Woodbury (1921)
2.5	Female	53.5	5.1
4.5	Male	57.0	7.4
5	Male	55.0	10.4
5	Male	55.5	9.9
9.5	Male	62.5	8.7

These cases of infantile marasmus had statures averaging 8.3 cm. below comparable averages from Woodbury (1921) for White infants lacking symptoms of sickness. While no case was shorter than the shortest cases included in the respective Woodbury distributions, all five cases fell at levels encompassed by the lowest one-fifth of the distributions.

Macy, Mary Sutton. **1912** The vegetative child: A biologic study of early child life. *The Child,* 2, 625-647.

Macy presented averages for stature at semiannual intervals from birth to two years. Her material was gathered from "examinations of 500 children" (p. 629). Subjects: Not described, probably residents of New York City.

STATURE (cm.) AVERAGES AT SEMIANNUAL AGES

Birth	6 mos.	12 mos.	18 mos.	24 mos.
52.6	66.5	70.4	75.7	81.3

These values were considered "indicative of the general tendencies" in stature growth during infancy.

Maresh, Marion M. and **Washburn,** Alfred H. **1938** Size of the heart in healthy children: Roentgen measurements of the cardiac area and transverse diameter for sixty-seven children between birth and the age of six years. *Amer. J. Dis. Child.,* 56, 33-60.

It will suffice to reproduce means for the birth weight subgroups at ages eighteen months and two years.

STATURE (cm.) OF PREMATURE INFANTS OF TWO BIRTH WEIGHT GROUPS

	18 mos.				24 mos.			
Birth Weight	Males		Females		Males		Females	
(gm.)	N	Mean	N	Mean	N	Mean	N	Mean
2000-2500	9	78.9	8	80.0	11	82.3	8	85.9
1000-1500	6	80.4	7	82.1	5	84.0	5	82.5

The paucity of data at ages below eighteen months was acknowledged. At no age was the number of full-term infants adequate. Compared with the means for White infants from Woodbury (1921), the means for "total" premature subjects were lower at two years for males, equal at eighteen months for males and at two years for females, and higher at eighteen months for females. In contrast, the means reported by Wallis (1931) on New York City nursery school children aged two years were markedly larger than the means at this age for the "total" prematures. In utilizing such comparisons to formulate an inference regarding the rate of growth in stature of prematurely born infants, it must be recognized a) that age was corrected for the degree of prematurity and b) exceptional environmental provisions were made to facilitate optimal growth.

Montague, Helen and **Hollingworth,** Leta Stetter. **1914** The comparative variability of the sexes at birth. *Amer. J. Sociol.,* 20, 335-370.

Measurements of stature "made immediately after birth" were taken from "obstetrical histories of the New York Infirmary for Women and Children . . . a hospital situated on the lower East Side of New York City" (pp. 337, 346). Records were rejected if marked "premature," "syphilitic," or "twin." The investigators began "with the last infant born and proceeded to transcribe from the records the measurements of 1,000 consecutive males and 1,000 consecutive females" (p. 345). Ethnic stock: "extremely heterogeneous . . . with Hebrews, Italians, and Slavs predominating . . . few Negroes, Turks, or Asiatics included" (p. 346). Socio-economic status: "very homogenous . . . there being very few from the economically well-to-do-classes" (p. 346). The data were probably accumulated during the years 1910 to 1914.

STATURE (cm.) OF NEW YORK (LOWER EAST SIDE) NEW-BORNS

	Number	Mean	S.D.	V	Percentiles		Range
					25th	75th	
Males	1000	50.5	3.00	5.9	48.7	52.5	38-62
Females	1000	49.9	2.93	5.9	48.1	51.8	35-59

With respect to central tendency, male infants were "longer than female infants." Males showed "slightly larger gross variation," through the Pearson coefficient indicated "no reliable difference" between the sexes in variability. Fifty per cent of the stature observations for each sex fell within a zone of less than four centimeters. One male and three females had readings below forty centimeters and one male a reading above sixty centimeters.

Nelson, Martha Van Kirk. **1930** The growth and nitrogen metabolism of infants receiving undiluted milk. *Amer. J. Dis. Child.*, 39, 701-710.

Stature in early infancy was studied for "nine well infants receiving undiluted mixtures of milk" (p. 702). Subjects: Male infants "kept under constant observation in a metabolism ward from the time they were 2 weeks of age until they were 6 to 10 months" (p. 702). Health: "None of the children suffered any noteworthy digestive disturbances while under observation. Infections of the upper respiratory tract ('colds') accompanied by slightly elevated temperatures were prevalent during January and February" (p. 704). Diet: "Each of the infants received 660 cc. of milk at 2 weeks of age. This amount was increased gradually to 900 or 1000 cc. at 6 months of age. Raw milk and corn syrup (6 per cent of the volume of the milk) were boiled vigorously for 3 minutes, cooled, and from 4 to 5 cc. of lactic acid added to each quart of milk . . . After each feeding, from 10 to 20 cc.

Stature data were published on 67 "average healthy" Denver infants examined repeatedly. The data were collected between 1932 and 1937 on 38 males and 29 females by the Child Research Council, University of Colorado. Ancestory: Almost entirely northwest European, upwards of 90 per cent of parents and 70 per cent of grandparents American-born. Socio-economic status: Around 30 per cent of fathers in professional or managerial groups, 60 per cent in minor managerial or skilled trades groups, 10 per cent semiskilled or unskilled.

STATURE (cm.) OF DENVER INFANTS OF MIDDLE AND UPPER CLASSES

Age	*Males*			*Females*		
(mos.)	Cases	Mean	Range	Cases	Mean	Range
1	28	53.9	50.0-60.5	22	52.9	48.3-58.0
2	37	57.5	53.5-62.5	27	56.5	53.3-61.0
3	38	60.3	56.3-65.6	28	59.3	53.8-64.3
6	37	67.1	63.0-73.0	28	65.5	61.0-71.8
9	36	71.3	66.5-81.0	28	70.4	63.8-77.0
12	35	75.2	70.0-80.4	28	74.3	69.3-78.8
15	35	78.6	74.3-85.0	26	77.5	72.5-81.8
18	33	81.8	77.5-88.0	26	80.7	75.0-85.0
24	30	87.6	84.5-93.4	25	86.4	81.3-91.8

The relationship (Pearson product-moment correlation) between stature at one month and stature at one year (46 cases) was .54. Between stature at one month and at two years it was .50 (39 cases). Specific for sex, the coefficients were .42 for males (25 cases) and .65 for females over the shorter period and, over the longer period, .51 for males (21 cases) and .47 for females.

For 10 males and 7 females, seriatim measurements were given at one month of age, at quarterly intervals from three to twelve months, and at eighteen and twenty-four months.

STATURE RECORDS FOR SEVENTEEN "AVERAGE HEALTHY" INFANTS

Subject	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.
				Males			
1	52.5	62.3	69.3	71.3	76.5	82.0	88.0
3	54.5	62.0	67.3	71.5	73.8	81.5	89.0
8	53.5	59.5	66.5	70.4	74.0	80.0	86.0
9	50.0	57.0	63.5	68.0	72.0	79.5	85.0

Subject	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.
Males							
13	52.5	59.0	68.0	70.5	76.5	82.5	88.0
19	55.3	61.8	69.0	74.5	77.0	84.0	90.0
23	52.0	57.5	64.0	69.8	73.5	80.5	86.0
26	51.5	59.8	67.0	72.8	76.3	81.8	86.5
28	51.0	56.3	65.5	68.8	72.5	77.5	84.5
35	51.5	57.0	65.0	70.7	75.3	80.0	86.8
Females							
39	52.8	58.5	61.5	66.5	72.0	78.5	83.5
45	49.5	55.5	61.0	63.8	69.5	75.0	81.5
48	51.5	58.0	63.0	69.3	71.5	80.0	85.5
50	52.0	59.3	64.0	70.0	75.5	82.5	89.5
52	58.0	63.8	70.5	74.5	78.0	84.5	91.3
55	52.3	60.8	64.0	67.8	71.0	75.5	81.5
62	53.0	59.8	66.5	71.6	75.5	84.5	91.8

Compared with the values for Subject 1 (male), Subject 8 was taller by 1.0 cm. at age one month, shorter by 2.8 cm. at three and six months, and shorter by 2.0 cm. at eighteen and twenty-four months. The stature records for subjects 39 and 62 (females) were practically equivalent at one month, but differed to the extent of 5.0 cm. at six months and 8.3 cm. at two years.

McLeish, (Mrs.) Andrew. **1898** Observations on the development of a child during the first year. *Trans. of Ill. Soc. for Child-Study,* 3, No. 2, 109-124.

Data for recumbent stature, obtained from repeated measurement of vertex-heel length at each month during the first postnatal year, were accumulated on a single female infant. Parents: "Scotch father . . . American mother." Subject: "youngest of a family of five"; born in March, so "had the whole long summer in which to live out of doors"; resided "in the genuine country, on a high bluff on the shores of Lake Michigan, in the midst of large grounds" (p. 109).

STATURE (cm.) OF SCOTCH-AMERICAN FEMALE INFANT

1 mo.	3 mos.	6 mos.	9 mos.	12 mos.
62.2	65.4	74.3	79.4	81.3

The infant was unusually tall. At six months of age her stature surpassed the Holt (1897) and Shinn (1893) values for one year, exceeding their figures at six months of age by upwards of ten centimeters.

Meredith, Howard V. **1935** The rhythm of physical growth: A study of eighteen anthropometric measurements on Iowa City white males ranging in age between birth and eighteen years. *Univ. Ia. Stud. Child Welf.*, 11, No. 3, Pp. 128.

Stature records were analysed on 210 White male infants examined 1926-34 at the infant laboratory of the Iowa Child Welfare Research Station, University of Iowa. Material: All available records for infants free from observable physical deformity and disease sysmptoms at the time of examination. Subjects: Iowa City residents, upwards of 90 per cent of northwest European ancestry. Parents: Above average economically and culturally; over one-half in the profession and managerial groups and more than 40 per cent of the skilled or semiskilled classes; interested in taking their infants to a laboratory for seriatim physical and mental examination. Measurements were obtained in the position of dorsal recumbency below eighteen months and in the erect position at older ages.

STATURE (cm.) OF IOWA CITY MALE INFANTS OF "ABOVE AVERAGE" CLASSES

Age Group							Increase in Mean	
Midpoint	Range (mos.)	N	Mean	S.D.	V	Range	Absolute	Percentage
1.5	0 thru 2	55	55.4	3.90	7.0	46-64		
4.5	3 thru 5	117	65.4	2.89	4.4	58-73	10.0	18.0
7.5	6 thru 8	159	70.6	2.85	4.0	64-78	5.2	7.9
10.5	9 thru 11	154	74.8	2.90	3.9	68-83	4.2	6.0
13.5	12 thru 14	145	78.2	2.66	3.4	73-87	3.4	4.5
16.5	15 thru 17	125	81.2	2.51	3.1	73-87	3.0	3.8
19.5	18 thru 20	117	84.4	2.85	3.4	78-91	3.2	4.0
22.5	21 thru 23	103	87.2	2.92	3.4	81-98	2.8	3.3
25.5	24 thru 26	105	89.9	3.11	3.5	82-99	2.7	3.0

The values for absolute and percentage increment exhibited a markedly decreasing rate of growth during the early postnatal months and a more gradual decline thereafter.

In order to secure averages at quarterly ages from three months to two years, the above means were plotted against age and subjected to graphic interpolation.

3 mos.	6 mos.	9 mos.	12 mos.	15 mos.	18 mos.	21 mos.	24 mos.
61.7	68.4	72.7	76.5	79.6	82.7	85.7	88.5

The average at three months coincided with that of Woodbury (1921) for Iowa males. From six to twelve months the averages were similar to those for Bakwin, Bakwin and Milgram's (1934) clinic series of the Fifth Avenue Hospital, while at eighteen and twenty-four months they approximated those of Stuart (1934). Over the entire period the values were practically equivalent to the Bayley and Davis (1935) figures for Berkeley males.

Meredith, Howard V. **1940** The stature of Iowa City infants representing northwest European ancestry, the professional and managerial classes, and the decade 1930-39. Unpublished study, Univ. Ia.

An analysis was made of stature data for White infants between the ages of two and twenty-six months. The data were accumulated at the Iowa Child Welfare Research Station during the decade beginning January, 1930, and ending December, 1939. Subjects: 469 Iowa City infants—263 males and 206 females—drawn exclusively from northwest European ethnic groups and from the professional and managerial classes.

STATURE (cm.) OF IOWA CITY INFANTS OF UPPER CLASSES MEASURED 1930-39

Age Group						Percentiles		
Midpoint	Range (mos.)	Number	Mean	S.D.	V	25th	75th	Range
				Males				
3	2 to 4	63	61.8	2.91	4.7	59.8	63.9	54.7-67.6
6	5 to 7	105	68.4	2.78	4.1	66.7	70.3	62.8-75.3
9	8 to 10	109	73.0	2.51	3.4	71.4	74.6	67.1-79.5
12	11 to 13	114	77.1	2.83	3.7	75.2	78.7	69.7-84.2
15	14 to 16	101	80.1	2.49	3.1	78.4	81.9	72.8-85.8
18	16 to 20	101	83.5	3.04	3.6	81.4	85.6	77.5-92.3
24	22 to 26	105	88.9	3.33	3.8	86.8	90.7	81.3-98.0
				Females				
3	2 to 4	42	60.0	2.74	4.6	58.5	61.8	52.5-66.8
6	5 to 7	86	66.2	2.46	3.7	64.9	67.8	58.9-72.5
9	8 to 10	101	71.1	2.50	3.5	69.2	72.8	65.3-77.5
12	11 to 13	93	75.0	2.52	3.4	73.1	77.0	67.5-80.6
15	14 to 16	84	78.6	2.65	3.4	76.8	80.5	72.8-86.8
18	16 to 20	101	81.8	2.68	3.3	80.0	83.6	76.2-89.4
24	22 to 26	72	87.2	2.76	3.2	85.5	89.3	81.1-92.6

There were records on 69 infants at the ages of three months and one year, and on 36 infants at the ages of three months and two years. Correlation of these paired values gave relationships of $r=.51$ for the latter ages and $r=.74$ for the former ages. The coefficient expressing the association between stature at three months and at two years ($r=.51$) was found to be lower than the comparable figures of Bayley and Davis (1935) or of Simmons and Todd (1938), but similar to that from the Maresh and Washburn (1938) data for stature at one month and at two years. In the case of stature at three months with stature at one year, the coefficient obtained was not appreciably different from the Simmons and Todd values of .66 for males and .72 for females.

Meredith, Howard V. **1941** Stature in infancy, with special reference to increments and individual growth patterns. Unpublished study, Univ. Ia.

Stature during infancy was studied with special reference to increments and individual growth patterns. Increment data were analysed for the age intervals from three months to one year, and from one to two years. These data were derived from stature measurements accumulated during the years 1930 through 1940 on 293 Iowa City infants drawn predominantly from the middle and upper classes.

GAIN IN STATURE (cm.) OF IOWA CITY WHITE INFANTS STUDIED 1930-1940

Age Interval (mos.)	Number	Mean	Percentiles 25th	Percentiles 75th	Range
		Males			
3 to 12	82	15.4	14.1	16.7	12.4-19.0
12 to 24	108	11.7	10.8	12.7	8.8-15.1
		Females			
3 to 12	65	14.9	13.9	16.0	11.6-18.3
12 to 24	104	12.4	11.5	13.6	9.0-16.1

Seriatim measurements of stature, together with cumulative information on dietary and health history, were obtained on a small group of individuals followed from birth. The subjects, here, were 18 Iowa City residents of northwest European descent, 10 representing the professional and managerial classes and 8 the unskilled and semiskilled groups. They lived in their own homes and were under pediatric guidance only to the extent that their parents voluntarily availed themselves of the current community resources (in other words, no attempt was made to have the parents participate in a particular program of nutritional and health care). The data were collected as part of a research project initiated in 1940 and having as its central purpose the collation of a series of dependable individual growth curves. Consequently, exceptional and sustained attention was given to their reliability.

STATURE RECORDS (cm.) FOR EIGHTEEN IOWA CITY WHITE INFANTS

Subject	Birth	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.
Professional and managerial subgroup							
Males							
C	51.0	62.0	69.7	75.9	79.3	85.5	91.0
Li	52.4	65.1	72.3	76.9	80.4	87.6	94.7
K	49.8	59.9	67.5	72.4	77.4		
Sc	50.2	59.8	66.1	70.0	73.3		
Females							
W	50.2	60.5	67.5	72.4	76.5	84.6	90.7
R	50.3	60.7	67.1	71.6	75.9	83.3	90.4
Co	50.4	59.8	65.2	69.1	72.6	80.0	84.8
Ko	51.4	62.1	68.2	72.6	76.1	82.3	85.4
O	52.0	62.2	67.9	72.5	76.0	83.4	88.3
Mc	49.6	60.5	67.1	70.8	74.3		
Unskilled and semiskilled subgroup							
Males							
Rg	50.0	60.9	68.5	72.9	75.8	82.7	86.8
Mo	50.5	60.4	66.8	71.2	74.6	81.7	87.3
M	51.4	60.9	67.0	71.3	75.9	84.1	89.6
S	49.5	60.4	68.1	72.4	76.5	83.0	
Re	50.0	61.5	68.2	72.5	75.5	81.8	
L	51.1	61.5	67.6	72.6	75.4		
Females							
Ri	48.2	58.4	63.8	68.4	72.4	79.7	
A	49.7	58.7	63.7	68.6	71.7	78.0	82.7

Material relating to the diet of each infant was itemized to yield a complementary tabulation.

infants physically deformed (e.g., talipes). On each infant, stature was determined within twenty-four hours after birth, independent measurements being secured by two anthropometerists. The stature of the mother was taken routinely at the time of discharge from the hospital.

STATURE (cm.) AT BIRTH OF IOWA CITY WHITE INFANTS BORN 1941

			Percentiles		
Number	Mean	S.D.	25th	75th	Range
100	50.4	1.60	49.5	51.4	45.5-54.3

The mean for males was 50.6 cm. and for females 50.2 cm. The correlation (Pearson product-moment) between stature of mother and stature of infant was .22 for males, .32 for females, and .25 for both sexes combined. On the whole, these coefficients were higher than those previously reported by Gunstad and Treloar (1936) and by Meredith and Brown (1937). In all three studies maternal stature showed a tendency to correlate more highly with the stature of female infants than male infants.

Meyer, Arthur William. **1915** *Fields, graphs, and other data on fetal growth.* Carnegie Institution of Washington, Publ. No. 222, Contr. Embryol. 2, No. 4, 57-68.

Stature medians were reported on White and Negro new-borns for whom the pregnancy period of the mother was between 236 and 320 days. Data: 2476 records each for stature at birth and duration of pregnancy; accumulated prior to 1910 at Johns Hopkins Medical School, Baltimore. The only records rejected were those with pregnancy periods of less than 236 days (calculated from beginning of last menstruation to parturition) and of 321 to 350 days.

STATURE (cm.) OF BALTIMORE WHITE AND NEGRO NEW-BORNS

Group	Number	Median	Group	Number	Median
White	1031	49.8	Males (White and Negro)	1033	49.6
Negro	1027	48.5	Females (White and Negro)	1026	48.7

The median stature for White neonates exceeded that for Negro, and the median for male neonates that for female. Of the White subjects, the longest was a female "with a duration of 287 days and a length of 59 cm.," the shortest "a female 40 cm. long . . . having a duration of 275 days" (p. 59). Of the Negro subjects, the longest was a female with a length of 58 cm. and a duration of 306 days, the shortest were three infants of 34 cm. with durations of 240, 270, and 310 days.

Mohr, George J. and **Bartelme,** Phyllis F. **1934** Developmental studies of prematurely born children. [In] Hess, Julius H.; Mohr, George J. and Bartelme, Phyllis F. *The physical and mental growth of prematurely born children.* Univ. Chicago Press. Pp. 449 (57-120).

A comparative study of premature and full-term infants, of twin and non-twin prematures, and of prematures with birth weights 1000-1500 gm. and 2000-2500 gm. was reported. Subjects: White; native-born; about 30 per cent Jewish and 60 per cent of northwest European ancestry; occupation of father, home ratings, and incidence of free hospital care showed them to "represent a slightly inferior socio-economic group" (p. 65.) Data: 162 stature records for premature infants (birth weight less than 2500 gm.) and 28 stature records for full-term infants; collected in Chicago 1929-33. The premature infants were the recipients of "excellent" postnatal care and follow-up afforded by the Premature Infant Station, Sarah Morris Hospital of Michael Reese Hospital. The full-term infants were siblings of the premature cases. In analysis, statutory age was used for the full-term cases and, for those prematurely born, statutory age minus the estimated amount of prematurity.

STATURE (cm.) OF CHICAGO PREMATURE AND FULL-TERM INFANTS

	Premature Infants						*Full-term Infants*	
Age	Twin		Non-twin		Total			
(mos.)	N	Mean	N	Mean	N	Mean	N	Mean
				Males				
3			5	53.5	5	53.5		
6	3	65.0	2	58.8	5	62.5	4	67.5
9	1	67.5	4	68.8	5	68.5	2	72.5
12			3	74.2	3	74.2	1	77.5
18	9	77.2	13	82.1	22	80.1	5	84.0
24	12	83.1	20	82.6	32	82.8	3	91.7
				Females				
3			3	55.8	3	55.8		
6	1	60.0	5	64.5	6	63.8	1	65.0
9	2	63.8	7	68.9	9	67.8	3	67.9
12			13	72.1	13	72.1		
18	7	78.2	22	80.6	29	80.0	7	80.0
24	6	83.3	24	84.1	30	83.9	2	85.0

DIETARY DATA ON EIGHTEEN IOWA CITY WHITE INFANTS

Subject	Duration of breast feeding (mos.)	Age (mos.) diet was supplemented with:				
		Orange juice, cod liver oil	Egg yolk	Cereal	Vegetables	Fruits
		Professional and managerial subgroup				
		Males				
C	4	.8	4.5	4.5	6	8
Li	0	.8	3	6	6	6
K	3	1.5	3	8	5	4
Sc	3.5	.8	8	8.5	6	8
		Females				
W	.8	1.5	3	10	5	3
R	0	.8	8	4	5	8
Co	5.5	.8	5.5	5.5	7.5	10
Ko	1	1.3	2.5	12	11	11
O	6	1.5	2.5	6	6	8
Mc	1.5	1	3	7.5	7.5	7.5
		Unskilled and semiskilled subgroup				
		Males				
Rg	1	.5	3	7.5	4	7.5
Mo	12	2	?	6	8	8
M	0	1.3	3.5	6	4	9
S	0	1	?	6	8	8
Re	9.3	2, 8	5.5	5.5	8	12
L	1	.8	3	9	6	3
		Females				
Ri	5	1.8	6	12	6	8
A	12	3, 8	12	10	6	7

Subject W was unable to utilize orange juice or eggs between five months of age and one year. After nine months, Subject Rg was given orange juice and cod liver oil "irregularly." Subject Re received orange juice from two months but no cod liver oil (or other vitamin D supplement) prior to eight months; after ten months both dietary components were discontinued. Subject A was not given cod liver oil until eight months of age and only intermittently following this age.

The illness records of the 18 subjects are conveniently reviewed in the same order as was followed in compiling the stature and dietary data. C had a minor eye infection the first month and three colds between eighteen and twenty-four months. Li was free from illness throughout the first year, but had two fairly severe colds and a digestive "upset" between seventeen and twenty months. K had occasional colic from the fourth to the sixth months, a severe cold in the eleventh month and intestinal "flu" in the twelfth. Sc developed a) a navel hernia in the second week which persisted to the tenth month, b) fairly severe colic during the latter part of the first month which lasted into the second month, c) a cold and "croupy cough" in the eighth month which "hung on" for four weeks, d) slight colds in the ninth and twelfth months and a moderately severe cold in the tenth. W gave blood in stools during the fourth week, had colds in the second, eighth and ninth months and in the twelfth month was sick for ten days with "pneumococcus of both ears." R had occasional colic during the first month, slight colds in the third and eighth months, chicken pox at eight months, and two colds during the second year. Co had a slight cold at eight months and a moderately severe cold at twenty months, while Ko had only a single slight cold in the tenth month. O developed six minor colds during the last half of the first year, a slight cold and "mild intestinal flu" during the last half of the second year. Mc had chicken pox in the fourth month, intestinal flu in the sixth, a severe cold in the eighth, and additional colds lasting two weeks each in the ninth, eleventh and twelfth months. Rg's record showed excessive vomiting during the first month, an operation for pyloric stenosis at one month, a slight cold in the eighth month, chicken pox in the tenth, a cold in the eleventh and no illnesses during the second year. Mo had a slight cold and cough the first month, a cold the second, severe whooping cough the sixth, a "throat infection" of five days duration during the twelfth, a cold and measles the sixteenth, a throat infection the seventeenth, and two colds plus a throat infection the twenty-second. M developed impetigo and a cold the sixth month, measles and a moderately severe cold the eleventh, a cold and intestinal flu the nineteenth and, between the twenty-first and twenty-fourth months, bronchitis lasting three weeks followed by a cold for another two weeks. S's record registered a) diarrhea for one week in the first month, b) a cold in the fifth month followed by severe croup lasting for four weeks, c) "flu" in the ninth month for three weeks—very severe one week, d) pneumonia early in the second year and a cold in eighteenth month. Re had occasional colic throughout the first six months, colds in the second, fifth, eleventh and twelfth months, and two fairly severe colds between twelve and eighteen months. L had colic the first month, a severe cold most of the fifth month, a less severe cold over most of the period from six to nine months, chicken pox at ten months and "flu" in the eleventh month. Ri developed colds the second, third, sixth, eighth, ninth and seventeenth months, together with chicken pox the ninth month and "rather severe flu" at twenty months. A showed mild symptoms of red measles in the third month and chicken pox in the tenth, respiratory infections were limited to three minor colds during the first year and one during the second.

Meredith, Howard V. and **Brown,** Addison W. **1937** Stature at birth in relation to sex, birth order, maternal age and stature. Unpublished study, Univ. Ia.

Study was made of stature at birth in relation to sex, age of mother, order of birth, and maternal stature. Subjects: 1040 White infants born 1930-33 at the University Hospitals, Iowa City; about 40 per cent were first-born, 40 per cent second-, third- or fourth-born, and 20 per cent fifth-born or higher; they represented consecutive deliveries except for rejection of cases designated premature (criterion 2500 gm.) or positive for some physical abnormality or disease condition. Mothers: Entirely of northwest European descent; the majority were from the lower socio-economic levels; all were free from syphilitic infection, toxemia of pregnancy, and analogous conditions of ill health; their mean age approximated twenty-four years.

STATURE (cm.) OF WHITE NEONATES BORN TO "HEALTHY" IOWA MOTHERS

Stature by sex

Sex	Number	Mean	S.D.	V	Percentiles		Range
					25th	75th	
Males	534	50.8	2.1	4.1	49.5	52.2	44.0-57.0
Females	506	50.2	2.0	4.0	48.8	51.5	45.0-57.5

Stature by birth order, maternal age, and maternal stature

	N	Mean	N	Mean	N	Mean
Order of Birth:	First		Second to Fourth		Fifth and Up	
Males	231	50.5	211	50.9	92	51.4
Females	182	49.8	210	50.3	114	50.6
Age of Mother (years):	15 to 20		21 to 27		28 to 45	
Males	192	50.6	214	50.8	127	51.2
Females	177	49.8	189	50.4	135	50.5

Stature by birth order, maternal age, and maternal stature—(Cont.)

	N	Mean	N	Mean	N	Mean
Stature of Mother (cm.):	122 to 157		158 to 164		165 to 183	
Males	131	50.5	184	50.7	143	51.4
Females	140	49.6	179	50.2	109	50.8

Correlation coefficients for newborn stature with maternal age and stature

	Maternal Age				Maternal Stature			
	Total Series		First-born		Total Series		First-born	
	N	*r*	N	*r*	N	*r*	N	*r*
Males	534	.09	231	−.03	481	.17	199	.21
Females	506	.10	182	.05	439	.21	152	.23

Univariate findings: The total males gave a larger mean than the females and were slightly more variable. With increasing birth order, maternal age, and maternal stature there was increase in the means for infant stature. The female infants of primiparous, young, and short mothers gave means 1.4 cm. to 1.6 cm. lower than those for male infants of the tallest, highest parity rank, and oldest mothers; the means for males of primiparous, young, and short mothers were practically identical with those for females of the tallest, highest parity order, and oldest mothers. Correlation findings: As determined by the Pearson product-moment method, the association between newborn stature and maternal age approximated .10 for the total series and zero for first-born infants. The coefficients for newborn stature with maternal stature were in the neighborhood of .20 for first-born infants and for male and female infants without regard to birth order.

Meredith, Howard V. and **Goodman,** Jack L. **1941** A comparison of routine hospital records of birth stature with measurements of birth stature obtained for longitudinal research. *Child Developm.*, 12, 175-181. (Also, Goodman, Jack L. 1941 Physical growth of infants from birth to three months. Unpublished master's thesis. Univ. Ia.).

Findings were obtained on the distribution of stature at birth, and on the association between infant and maternal stature. Subjects: 100 White neonates, 50 of each sex, born in 1941 at the University Hospitals, Iowa City, and varying in weight at birth from 2580 gm. to 4730 gm. Procedure: Cases were taken serially as birth occurred except for the exclusion of infants weighing less than 2500 gm., infants placed under special observation, and of distilled water was used to remove the curds adhering to the sides of the bottle, and these washings were fed to the infant" (p. 702). "Thirty cubic centimeters of orange juice was given daily until the infants were 3 months of age, and 60 cc. daily thereafter. One-half teaspoon of cod liver oil was given until 6 weeks of age, then 1 teaspoonful daily. Egg yolk was added to the feeding mixtures at age periods ranging from 3 to 6 months. Vegetables were added at 6 months and fruit sauces at 7 months" (p. 702). Birth stature: "At birth, the length of none of the infants exceeded 50.4 cm." (p. 705).

STATURE (cm.) OF IOWA CITY MALE INFANTS ON CONTROLLED DIET

3 mos.		6 mos.		9 mos.	
Number	Mean	Number	Mean	Number	Mean
9	61.8	8	69.3	4	75.1

The Richdorf (1925) figures for male infants considered to have received reasonably adequate dietary and health care were lower at three, six and nine months by 1.1 cm., 2.5 cm. and 4.3 cm., respectively. Nelson made the interpretation that such differences "indicate that feedings of undiluted milk . . . produce an increased rate of growth in length" (p. 710).

Palmer, Carroll E. **1932** The relationship of erect body length to supine body length. *Hum. Biol.*, 4, 262-271.

Results were presented from "a quantitative analysis of the difference between body length as measured in the erect and in the supine positions" (p. 262). The subjects ranged in age from eighteen months to twenty years, not more than 30 being two years or younger. The paired measurements on these young subjects were obtained by Dr. Edith Boyd at the nursery school of the Institute of Child Welfare, University of Minnesota. "Two parabolic curves were fitted by the method of least squares" to the total male and female observations. For a supine stature of 80 cm., the equations gave erect stature as 77.4 cm. for males and 77.9 cm. for females. Erect equivalents for a supine stature of 85 cm. were 82.8 cm. and 83.1 cm., respectively.

Peatman, John Gray and **Higgons,** Reginald A. **1938** Growth norms from birth to the age of five years: A study of children reared with optimal pediatric and home care. *Amer. J. Dis. Child.,* 55, 1233-1247. (See also, Higgons, Reginald A. and Peatman, John Gray. 1938 A study of growth norms from birth to five years for children reared with optimal pediatric and home care. *Trans. Amer. Therapeutic Soc.,* 38, 96-99.)

Peatman, John Gray and **Higgons,** Reginald A. **1939** Height-weight variability from birth to five years of age for children reared with optimal pediatric and home care. *J. genet. Psychol.,* 54, 165-180.

Stature during infancy was studied on 1112 private pediatric cases—577 males and 535 females—residing in several localities suburban to New York City (Rye, New York; Greenwich, Connecticut; and nearby towns of Westchester County, New York). Socio-economic status: Family income exceeded $3000 for roughly 60 per cent of the subjects. Ancestry: The majority of the subjects were "of American parentage, with North European stock apparently predominating" (p. 1237); those of foreign parentage (about 16 per cent) were mainly of Italian, Jewish and Polish stocks. Health care: Feeding and care was "reasonably optimal": the principles of feeding involved ample caloric intake, relatively high intake of protein, solid food, and vitamins, relatively low intake of carbohydrate, fat and total fluid; cod liver oil and orange juice or cevitamic acid were given at four weeks, cereals in the third month, egg yolk at three months, strained vegetables in the fourth month, liver at five months, milk and egg puddings at six months; sun baths were given from April to October and ultra-violet radiation during the winter months; the environment was studied "to insure ample rest and to prevent excessive or harmful stimulation" (p. 1234); unless the parents objected, each child received "diphtheria toxoid at the age of 8 mos., a Schick test at 12 mos., pertussis vaccine (Sauer) at from 12 to 15 mos." (p. 1234). Examinations: As far as practicable, examinations were made at one month after birth, at successive monthly intervals to one year, and at quarterly intervals from one to two years. Stature was taken nude and in the recumbent position throughout.

STATURE (cm.) OF NEW YORK INFANTS EXAMINED IN PRIVATE PEDIATRIC PRACTICE

Age Group		*Males*				*Females*			
Midpoint	Range (mos.)	N	Mean	S.D.	V	N	Mean	S.D.	V
1	0.5 to 1.5	150	54.9	2.2	4.0	129	54.1	2.3	4.3
3	2.5 to 3.5	183	61.5	2.6	4.2	160	60.2	2.4	3.9
6	5.5 to 6.5	156	68.6	2.3	3.3	147	66.3	2.4	3.7
9	8.5 to 9.5	122	73.2	2.4	3.3	116	71.1	2.7	3.9
12	11.5 to 12.5	144	76.7	2.6	3.4	152	74.4	2.9	3.9
15	14 thru 15	141	79.5	2.8	3.6	117	77.7	2.8	3.6
18	17 thru 18	108	82.0	2.8	3.4	106	81.0	3.2	4.0
24	23 thru 24	101	88.1	3.3	3.8	108	86.6	4.0	4.6

Intrinsic findings: At each age the mean for males exceeded that for females, the difference being 0.8 cm. at one month, 2.3 cm. at six and twelve months, and 1.5 cm. at twenty-four months; on the whole, females tended to be more variable than males. Absolute variability was somewhat greater in the second year than the first, while relative variability tended to be smaller during the latter half of the first year than in the early postnatal months or at two years. Comparative findings: The central tendency and variability values were compared with those from Woodbury (1921). The former were found to ''start at about the same average point (slightly below),'' and to ''slowly but steadily'' exceed the Woodbury values, the differences becoming ''statistically significant beginning with the fifth month'' (p. 1246). Peatman and Higgons ''advanced the hypothesis'' that this divergence in central tendency was ''possibly attributable'' to ''environmental conditions arising out of relatively optimal pediatric and home care'' in ''such variables as diet, sunshine, exercise and rest.'' (p. 174, 1247). Comment: In the interest of balanced perspective, it should be noted that the Peatman and Higgons means were not higher than those from several contemporary studies employing samples less highly selected with respect to diet and health care, *c.f.*, Bayley and Davis (1935) or Meredith (1935) and Boynton (1936). For a more thorough evaluation of the implications of Peatman and Higgons' results, the reader is referred to the sections of Part I treating ''Secular differences'' and ''Socio-economic differences.''

Peckham, C. H. **1938** Statistical studies on prematurity: I. The incidence of prematurity and the effect of certain obstetric factors. II. The mortality of prematurity and the effect of certain obstetric factors. *J. Pediat.,* 13, 474-497.

Records were analysed for neonates with vertex-heel lengths of less than 45.0 cm. accumulated at the Department of Obstetrics, Johns Hopkins Hospital, Baltimore, over a period of forty years. "A total of 39,394 deliveries of theoretically viable children occurred in the hospital and outside obstetric services from the beginning of the department in 1896 to Jan. 1, 1936. Among these . . . 2,415 were delivered who were less than 45 cm. in length . . . but weighing at least 1500 gm." (pp. 474-6). Of these 2415 infants, 48 per cent were males and 52 per cent females, 31 per cent White and 69 per cent Negro. The mothers of the Negro cases were "for the most part second- or third-generation tenement dwellers" (p. 482).

STATURE AND MORTALITY DATA FOR INFANTS UNDER FORTY-FIVE CENTIMETERS IN LENGTH

	Negro		*White*		*Both races*	
	N	Percent	N	Percent	N	Percent
			Stature			
Length (cm.):						
40-44						
Single births	1237	51.2	537	22.3	1774	73.5
Multiple births	125	5.2	68	2.8	193	8.0
35-39						
Single births	246	10.2	117	4.8	363	15.0
Multiple births	34	1.4	15	0.6	49	2.0
Less than 35						
Single births	13	0.5	12	0.5	25	1.0
Multiple births	8	0.4	3	0.1	11	0.5
			Mortality			
Males:						
Stillbirths	261	10.9	93	3.9	354	14.8
Neonatal deaths	174	7.2	97	4.0	271	11.2
Neonatal survivals	367	15.2	158	6.5	525	21.7
Females:						
Stillbirths	181	7.5	92	3.8	273	11.3
Neonatal deaths	143	5.9	78	3.2	221	9.1
Neonatal survivals	537	22.2	234	9.7	771	31.9

Finding: Statures of less than 45.0 cm. were recorded for 6.1 per cent of the total series; 4.0 per cent of the White series; 7.9 per cent of the Negro series; 3.6 per cent of the White, uniparous birth series; 7.3 per cent of the Negro, uniparous birth series; 20.2

per cent of the White, multiparous birth series and 35.2 per cent of the Negro multiparous birth series. It follows from these figures and from the tabulation above that "the incidence of small infants was almost twice as great in the black as in the white race" (p. 483). The tabulation also tends to confirm the statement that a "higher stillborn and neonatal death rate was noted in male as contrasted with female infants" (p. 497). Interpretation: Peckham expressed the "belief that present methods of establishing prematurity on the basis of weight, or length, or both, are grossly inaccurate. Allowances must be made for race, age, and parity of mother, as well as sex of infant. Separate standards are necessary for single and multiple births" (p. 483).

Peckham, George W. **1882** Various observations on growth. *Seventh Annual Report of the State Board of Health of Wisconsin.* Publ. Doc. No. 14, 185-188.

Stature means on 61 infants between one and two years of age were presented. Parents: Predominatly American- or German-born, probably residents of Milwaukee.

STATURE (cm.) OF MALE AND FEMALE INFANTS

Midpoint of	*Males*		*Females*	
Age Group	Number	Mean	Number	Mean
18 mos.	25	74.9	36	75.2

Finding: At one and one-half years after birth, the average stature for male and female infants approximated seventy-five centimeters.

Poole, Marsh W.; **Hamil,** Brenton M.; **Cooley,** Thomas B. and **Macy,** Icie G. **1937** Stabilizing effect of increased vitamin B (B_1) intake on growth and nutrition of infants. *Amer. J. Dis. Child.*, 54, 726-749. (See also, Colby, Martha G.; Macy, Icie G.; Poole, Marsh W.; Hamil, Brenton M. and Cooley, Thomas B. 1937 Relation of increased vitamin B (B_1) intake to mental and physical growth of infants. Ibid. 750-756.)

The association between growth in stature during the first postnatal year and the "early addition of the antineuritic factor, vitamin B_1, in the form of a water extract of rice polishings to an ordinary milk formula'' was investigated. Subjects: 117 full-term, non-twin, well infants ''living in their own homes and cared for by their own parents'' (p. 731); roughly two-thirds White and one-third Negro; considered ''a cross-section of the indigent and near-indigent class of the cosmopolitan population of Detroit'' (p. 731); studied 1934-35 through the Research Laboratory of Children's Fund of Michigan and the Children's Hospital of Michigan; artificially fed. When initially examined they ''ranged from 1 to 10 weeks of age, with an average of 5.5 weeks'' (p. 748). No ''congenital or inherent abnormality was detected at the time of the initial examination or subsequently'' (p. 731). Mothers: Instructed at a clinic and by visiting nurses regarding feeding management and health care; questioned monthly on such items as illness, sleep, amount of sunshine and fresh air; found to take ''satisfactory care of the infants'' (p. 734). Diet: The basic formula given all infants consisted of ''evaporated milk, water and corn syrup acidified by the addition of commercially dehydrated lemon juice powder'' (p. 749); cereal was added at four to five months, strained carrots and peas five to six months, prune pulp and apple sauce six to seven months, and eggs at eleven months; cod liver oil was given to yield 250-600 U.S.P. units of vitamin D. Subgroups: ''At the first visit to the clinic, the babies were assigned . . . alternately to two groups'' (p. 732); one group received ''formula containing evaporated milk to which at the time of manufacture had been added vitamin B (B_1) in the form of a water-soluble extract of rice polishings'' while the other group was given a formula which ''contained no vitamin B extract'' (p. 732); ''the average estimated vitamin B_1 content of the supplemented formula was approximately 320 Sherman-Chase Units'' (p. 733) and of ''the non-supplemented formula was 227 Sherman-Chase units'' (p. 739). Of the 66 experimental and 51 control cases, none was under study less than two months, while an unspecified number was followed to one year.

STATURE (cm.) OF DETROIT INFANTS ON SUPERVISED DIETS

Group	3 mos.	6 mos.	9 mos.	12 mos.
Experimental	60.0	66.5	71.0	75.2
Control	60.1	67.0	71.1	75.7

Findings: 1) The average rate of growth over the first year was not appreciably different for the two groups, 2) the month-by-month gains were reported as fairly consistent for the experimental series and "more irregular" for the control group. Interpretations: Regarding the first finding the experimenters suggested the probability that the basic dietary formula contained sufficient nutrients to satisfy the maximum impulse of growth, "so that further increase in the vitamin B level of the diet could not further stimulate the process of growth" (p. 739). Relative to the second finding they stated, "We believe that vitamin B has a stabilizing effect on growth" (p. 739). Comment: The "greater regularity of growth" for the experimental group was not apparent from inspection of the graph presented and, if accepted, may have reflected nothing more than the "stabilizing effect" expected for the larger of two such small samples.

Poole, Marsh W.; **Hamil,** Brenton M.; **Cooley,** Thomas B. and **Macy,** Icie G. **1938** Addition of vegetable soup and strained vegetables to diet of artificially fed infants. *Amer. J. Dis. Child.,* 55, 1158-1175. (Also, personal communications, December, 1942.)

Investigation was made of the relationship between growth in stature during the first postnatal year and the early addition of "vegetable soup reenforced with wheat germ" to the diet of artificially fed infants. Subjects: 215 full-term, White and Negro infants; secured for study by the Children's Fund of Michigan through cooperation with the Children's Hospital of Michigan, Detroit Department of Health, Harper Hospital, Florence Crittenton Hospital, Woman's Hospital and private physicians in Detroit; "of the indigent or near-indigent class . . . For the most part . . . represented the factory laboring people of Detroit." The subjects "lived in their own homes under the care of their own parents, with adequate nursing supervision" (p. 1167). Diet: The basic diet consisted of "evaporated milk, water, and corn syrup with its supplements of powdered lemon juice and cod liver oil" (p. 1167). Cereals and strained vegetables were introduced during the fifth and sixth months, strained fruit at the age of six or seven months. Subgroups: The subjects were subdivided into a "control" series of 77 infants and an "experimental" series of 138 infants. The percentage of Negro infants was "essentially the same" for each group. There was "little difference in amount of illness''—nasopharyngitis, otitis media, bronchitis, diarrhea and eczema being represented in both groups. The experimental series received supplementary vegetable soup, beginning at "the ages of 2 to 8 weeks.'' This soup was made from "peas, carrots, spinach, rice, barley, beef, tomatoes and celery (in order of decreasing occurrence) and wheat germ'' (p. 1168). The amount given was gradually increased from one to eight teaspoonfuls daily, being maintained at the latter amount after six to eight weeks of age.

STATURE (cm.) OF DETROIT INFANTS GIVEN DIETARY SUPERVISION 1934-36

Group	3 mos.	6 mos.	9 mos.	12 mos.
Experimental	59.8	67.5	71.8	76.0
Control	59.8	67.7	71.8	76.2

The values at three, six and nine months were read from a graph. The values at one year were obtained through personal communication. In acknowledging the practical identity of the results for the two groups, the authors stated that the early addition of vegetable soup "did not significantly influence'' average stature (p. 1174). It was their interpretation that "owing to the adequacy of the basal diet'' both groups "developed satisfactorily'' (pp. 1169-74).

When the data at one year of age were pooled with reference to diet, and distributed for race and sex, the following tabulation accrued.

STATURE (cm.) OF INFANTS OF LOWER CLASSES GIVEN DIETARY SUPERVISION

Age Group		*White*				*Negro*		
Midpoint	Range (mos.)	N	Mean	Range		N	Mean	Range
					Males			
12	11 thru 12	60	76.6	72.3-81.5		25	76.7	72.8-80.9
					Females			
12	11 thru 12	41	74.8	70.2-81.5		21	76.3	71.1-79.9

The means for Negro infants reported by Woodbury (1921) were lower than the comparable means here by 5.3 cm. for males and 5.0 cm. for females.

Raiford, T. E. **1938** The relationship between height and weight of male and female infants between the ages of two weeks and one year. *Hum. Biol.*, 10, 409-416.

The stature data subgrouped for vitamin D intake by Slyker, Hamil, Poole, Cooley and Macy (1937), were analysed by Raiford for "males and females taken separately" (p. 410). Subjects: 472 infants within the age limits of two weeks and thirteen months, "racially . . . the conglomerate representing the industrial population of the city of Detroit" (p. 410); of the indigent and near-indigent classes; not removed from their homes but prescribed "carefully balanced" diets and supervised. Examinations: Made at frequent intervals, subjects nude, at the Research Laboratory of the Children's Fund of Michigan.

STATURE (cm.) OF LOWER CLASS, DIET SUPERVISED, INFANTS EXAMINED 1933-36

Age Group		*Males*		*Females*	
Midpoint	Range (wks.)	Number	Mean	Number	Mean
4	2- 6	144	54.5	108	53.5
12	10-14	240	60.3	186	58.8
26	24-28	209	67.8	161	66.0
40	38-42	175	72.9	136	71.1
52	50-54	136	76.6	91	75.0

Raiford considered mean stature for the first year to "follow very closely a law of the form $x=k_0+k_1y+k_2y^2$, where x denotes age and y denotes stature" (p. 416). Equations of this form were determined, using the method of least squares, and found to yield "average errors of prediction" of 0.7 cm. for males and 0.6 cm. for females.

Rapoport, Milton and **Stokes**, Joseph, Jr. **1936** The antirachitic value of irradiated evaporated milk and irradiated whole fluid milk in infants. *J. Pediat.*, 8, 154-160.

Gain in stature between approximately two and seven postnatal months was studied on a small series of infants fed "irradiated evaporated milk and irradiated whole fluid milk." Subjects: 14 White infants housed at the Children's Hospital, Philadelphia, 1934-35. All were negative for syphilis and tuberculosis; three gave "X-ray evidences of very mild rickets" at the time of initial examination—"No roentgenographic evidences of rickets developed during the period of study" (pp. 154, 160). Diet: Eight infants were placed on irradiated evaporated milk, diluted 50 per cent with water, and the remaining six on irradiated whole fluid milk, undiluted. The former formula "had a vitamin D content of 125 U.S.P. units per 14.5 ounce can," the latter "about 140 U.S.P. units per quart" (p. 154). Five per cent dark corn syrup was added to both types of formula. "These milk mixtures were offered to the infants on the basis of 55 calories per pound of expected body weight" (p. 156). Cereals and vegetables were added at six months. Alternate infants were fed orange juice or cevitamic acid. "Ferric ammonium citrate was added (2 per cent) to both the orange juice and the cevitamic acid solution" (p. 156).

STATURE GAIN OF PHILADELPHIA INFANTS UNDER CONTROLLED DIETS

Group	N	Experimental period (mos.): Mean age at beginning	Experimental period (mos.): Duration	Mean Gain in stature (cm.)
Evaporated milk	8	2.2	4.5	11.2
Fluid milk	6	2.0	4.5	11.4
Both combined	14	2.1	4.5	11.3

"The irradiated evaporated and the whole fluid milks appeared to be equally efficacious in preventing the development of rickets" and in influencing growth in length.

Rhoads, Teresa Folin; **Rapoport,** Milton; **Kennedy,** Ruth and **Stokes,** Joseph, Jr. **1941** Studies on the growth and development of male children receiving evaporated milk: I. The effect of various vitamin supplements on growth in length and incidence of rickets during the first two years of life. *J. Pediat.*, 19, 169-189.

Investigation was made of the "influence of supplements of vitamins A, D, and B complex" on the stature of infants receiving "evaporated milk as their sole source of milk." Subjects: 233 male infants, 134 White and 99 Negro; largely drawn from "the lower income groups" (p. 169); all "had birth weights of 5 pounds or more" (p. 170). The White subjects were 57 per cent of northwest European descent, 25 per cent of Italian extraction, 11 per cent of mixed European stocks, and 7 per cent of Slavic ancestry.

Data: Collected between 1936 and 1940 at the "Out-Patient Department of the Children's Hospital of Philadelphia," measurements of each subject being obtained at frequent intervals "from an average initial age of 6 weeks until the age of 2 years" (p. 188). Basal diet: From the time of the first examination all infants received evaporated milk and orange or tomato juice. "Banana and cereal were started at 3 to 4 months, pureed vegetables and fruits at 5 to 6 months, and potato and meat at 8 to 10 months . . . Iron ammonium citrate (18 grains daily) or a solution of ferrous sulfate (6 grains daily) was given when the hemoglobin was below 13 Gm. per 100 c.c." (p. 171). Groups: "The infants were divided into four groups according to vitamin supplements" (p. 188). Groups I, II, and III "received 110 U.S.P. units of vitamin D daily in the form of irradiated evaporated milk"; Groups II and III, "10 drops of carotene (equivalent to approximately 2250 U.S.P. units of vitamin A)"; and Group III, "0.5 tablespoonful of brewer's yeast powder daily (approximately 250 units of vitamin B_1 and 250 Sherman units of vitamin B_2)" (p. 170). Group IV was given nonirradiated evaporated milk supplemented with "approximately 1500 U.S.P. units of vitamin D and 15,000 U.S.P. units of vitamin A daily in three teaspoons of cod liver oil" (p. 170). For all groups, "the milk and the vitamin supplements were delivered at the homes every two weeks by the nurse and by the social worker" (p. 171). There was "little difference between the groups" in the incidence of colds, diarrhea, otitis media, eczema, or other illness conditions.

STATURE (cm.) OF PHILADELPHIA LOWER CLASS MALE INFANTS GIVEN DIETARY SUPERVISION

Group	N	3 mos.		12 mos.		24 mos.		Increment (3 to 24 mos.)	
		Av.	S.D.	Av.	S.D.	Av.	S.D.	Absolute	%-age
				White Males					
I	48	59.9	3.81	74.4	3.64	85.6	4.38	25.7	42.9
II	24	59.6	4.27	74.3	4.01	85.7	5.23	26.1	43.9
III	20	59.5	6.12	75.1	5.17	86.7	7.50	27.2	45.7
IV	42	58.7	3.58	73.9	3.39	85.6	3.98	26.9	45.8
				Negro Males					
I	32	59.3	4.41	74.5	4.97	85.8	5.40	26.5	44.6
II	17	59.1	6.91	74.7	7.08	86.4	11.00	27.3	46.2
III	19	58.6	4.42	74.8	5.99	86.2	8.88	27.6	47.2
IV	31	58.8	5.29	75.0	6.25	87.0	7.71	28.2	48.1

"There was no significant difference in length between any of the groups at 3 months, 1 year, or 2 years" (p. 188). The Negro infants tended to show greater gains than the White infants. Between the ages of three months and two years, the average gain for the 73 White and Negro infants "receiving 1500 units of vitamin D in the form of cod-liver oil" was 27.5 cm. (46.8 per cent), as compared with an average gain of 26.0 cm. (43.6 per cent) for the 80 infants "receiving 110 units of vitamin D in irradiated evaporated milk without added vitamins A and B" (pp. 188-9).

The report of Rhoads, Rapoport, Kennedy and Stokes permitted calculation of average stature at several ages from a pooling of the four dietary groups.

STATURE (cm.) OF WHITE AND NEGRO MALES OF SIMILAR SOCIAL CLASS AND DIETARY

Race	N	3 mos.	6 mos.	9 mos.	12 mos.	15 mos.	18 mos.	24 mos.
White	134	59.4	66.2	70.8	74.3	77.7	80.7	85.8
Negro	99	59.0	66.2	71.1	74.8	78.0	81.2	86.4

The increase in average stature between three months and two years was 26.4 cm., or 44.4 per cent, for the White males, and 27.4 cm., or 46.4 per cent, for the Negro males.

Richdorf, Lawrence F. **1925** A quantitative study of the growth of the normal infant in the first year. Unpublished doctoral dissertation. Univ. Minn. Pp. 207.

Utilizing 394 different infants, Richdorf accumulated 593 measurements of recumbent stature distributed about equally in each of the first twelve postnatal months. Subjects: "all Caucasian . . . majority of Northern European extraction"; residents of Minneapolis, St. Paul, and Rochester, Minnesota; negative for congenital abnormality, prematurity, birth injury, acute and chronic disease, and "nutritional disorder." Fathers: "skilled workmen, tradesmen, or professional men" (p. 14). Diet and health care: "Medical attention and instruction in child care was available for the mothers . . . urged to breast feed their babies. Solid food (cereal well cooked) was begun from the fourth to the seventh month, and vegetables about a month later . . . Orange juice was given in all cases . . . Cod liver oil and sunlight were recommended almost routinely" (pp. 15-16).

STATURE (cm.) OF MINNESOTA URBAN INFANTS OF MIDDLE AND UPPER CLASSES

Age Group						Percentiles	
Midpoint	Range	Number	Mean	S.D.	V	25th	75th
			Males				
7 days	3 to 10	24	51.5	1.60	3.1	50.5	52.6
6 wks.	4 thru 7	25	56.1	2.33	4.2	54.2	57.6
3 mos.	2 thru 3	50	60.7	2.25	3.7	59.4	62.3
6 mos.	5 thru 6	50	66.8	2.34	3.5	65.1	68.3
9 mos.	8 thru 9	49	70.8	2.54	3.6	69.3	72.3
			Females				
7 days	3 to 10	23	51.3	0.98	1.9	50.5	52.0
6 wks.	4 thru 7	27	55.6	2.08	3.7	54.6	57.6
3 mos.	2 thru 3	50	58.8	2.22	3.8	58.0	60.3
6 mos.	5 thru 6	48	66.0	2.05	3.1	64.4	67.7
9 mos.	8 thru 9	48	70.3	2.35	3.3	68.4	71.9

Mean stature at nine months was roughly nineteen centimeters, or 37 per cent, greater than mean stature at one week. The increase between one week and three months was about double that between six and nine months. At no age studied did the central one-half of the statures scatter over a zone exceeding 3.5 cm.

Riggs, Theodore F. **1904** A comparative study of White and Negro pelves, with a consideration of the size of the child and its relation to presentation and character of labor in the two races. *Johns Hopkins Hospital Reports,* 12, 421-454.

Averages from stature measurements taken "within an hour" after birth were reported, based upon records of the Obstetrical Department, Johns Hopkins Hospital, Baltimore. Records were taken in chronological order except for omission of "all premature labors and abortions, multiple pregnancies," and infants measuring less than "40 cm. in length" (pp. 422-23). Subjects: 779 White and 721 Negro infants. White cases: Majority American-born parentage, 52 per cent males, 56 per cent infants of primiparae. Negro cases: 50 per cent males, 47 per cent infants of primiparae, "no separate note of the mulattoes, since their number was comparatively small and their degree rarely exceeded that of the quadroon" (p. 423). The influence of parity was studied "in a series of 961 cases" (p. 440).

STATURE (cm.) OF BALTIMORE WHITE AND NEGRO NEW-BORNS

	Total Sample		*Infants of Primiparae*		*Infants of Multiparae*	
	Number	Average	Number	Average	Number	Average
White	779	49.7	370	49.7	227	50.0
Negro	721	48.4	196	48.5	168	48.9

Typically, the Negro neonates were shorter than the White, and the neonates of primiparae shorter than those of multiparae.

Robinson, Edith C. **1940** A study of two hundred and forty breast-fed and artificially fed infants in the St. Louis area: I. A comparison of prophylactic antirachitic effects of 135 and 200 unit irradiated evaporated milks, 200 unit irradiated fresh milk and human and nonirradiated evaporated milk fortified with 800 to 1,000 units of vitamin D as viosterol. *Amer. J. Dis. Child.*, 59, 816-827.

Study was made of the effects on rate of growth and incidence of rickets "of different types of vitamin D administration" (p. 816). Subjects: 208 "normal, healthy infants," 103 males and 105 females, 184 White and 24 Negro. The infants were born during 1937-39 at the St. Louis Maternity Hospital and the St. Louis City Hospital," and in every instance weighed "at least 5 pounds at birth" (p. 816). Their mothers, mostly primiparae, were "intelligent and willing to cooperate." Procedure: The subjects were a) divided into five experimental groups with reference to "type of feeding and source of vitamin D," b) "put on the formula of their respective group before the tenth day of life" (p. 816), and c) followed for gain in stature and incidence of rickets over a six-month period. Diet groups: Group I consisted of "breast-fed infants who received 5 drops of viosterol in oil (800-1,000 U.S.P. units of vitamin D) daily," Group II was fed "nonirradiated evaporated milk plus 5 drops of viosterol daily," Group III received "irradiated evaporated milk assaying 135 U.S.P. units of vitamin D to the reconstructed quart," Group IV was fed "irradiated evaporated milk assaying 200 units," and Group V received "irradiated whole milk assaying 200 units" (pp. 816-7). The infants of Group I were breast-fed for minimum of three months. The infants of Groups III, IV and V had an average milk intake of "no more than 75 per cent of the possible quart. Hence . . . the full unit value of vitamin D was not consumed'' (p. 821). All infants were started on orange juice by six weeks, cereal was added ''when the child weighed 12 to 13 pounds . . . and then vegetables, fruit and other foods as tolerated'' (p. 817). The milks and viosterol were supplied to the parents. In the event an infant ''became ill the mother communicated with the clinic and received advice or brought her baby in for treatment'' (p. 817). Illness history: ''Most of the infections that occurred involved the upper respiratory tract—colds, otitis, pharyngitis and so on. In a few infants exanthem subitum, in a few stomatitis and in 1 or 2 mumps occurred'' (p. 820). Analysis of data: In addition to separate treatment of the five diet groups, subanalyses were made to determine the stature gains of those infants on each diet who showed definite roentgenographic evidence of rickets at one or more of the clinic examinations.

STATURE (cm.) GAIN OVER A SIX-MONTH PERIOD FOR FIVE DIET GROUPS

	Total Series			*Rachitic Series*	
Group	Number	Average Gain	Percentage with Rickets	Number	Average Gain
I	37	12.8	2.7	1	14.2
II	42	14.1	47.6	20	13.7
III	53	14.5	39.6	21	15.6
IV	51	15.2	41.2	21	15.1
V	25	17.5	24.0	6	17.9

It was not explicitly stated whether these stature gains represented the period from birth to six months, the period extending six months from ''the first visit to the clinic when between 5 and 6 weeks of age,'' or six-month periods with varying limits between birth and one year. There was seeming support for the latter possibility in a statement that for the one rachitic case of the breast-fed group, rickets ''appeared at the seventh month (p. 821). Findings: Disregarding dietary differences, the average gain was 14.7 cm. for the entire series of subjects and 15.1 cm. for those subjects (33.2 per cent) showing roentgenographic evidence of rickets. These figures indicate ''no appreciable difference in the rate of linear growth'' for the rachitic infants. With reference to diet, the 37 infants receiving breast milk and viosterol gave practically no evidence of active rickets and a stature gain 1.9 cm. below the gross average, while the 25 infants fed 200-unit fresh homogenized milk gave a low incidence of rickets and a stature gain 2.8 cm. above the average. The incidence of active rickets was not higher for the Negro than for the White infants.

Rude, Anna E. **1922** *Physical status of preschool children, Gary, Indiana.* Children's Bureau, U. S. Dept. of Labor Publ. No. 111. Washington: Gov't. Printing Office. Pp. 84.

Stature data were analysed on 1107 infants ranging in age from birth to twenty-six months. Data: Collected in 1918 at Gary, Indiana, through well advertised health conferences. Mothers: About 61 per cent foreign-born White, 37 per cent native White, and 2 per cent Negro. "The principal foreign nationalities represented were the Slavic groups—including Polish, Serbo-Croatian, and Slovak"; British stocks formed "the principal element in the native white population" (pp. 34-5). The annual income of the "chief breadwinner" was less than $1500 in more than 60 per cent of cases. The sample was considered representative of Gary in 1918. Stature was measured recumbent on infants "too young to stand" and erect, against a board, at later ages. Two determinations were made on each child, "the second figure serving as a check on the previous one" (p. 21).

STATURE (cm.) OF INFANTS IN AN "INDUSTRIAL CENTER"

Age Group		*Males*		*Females*	
Midpoint	Range (mos.)	Number	Average	Number	Average
1	0 thru 1	13	55.2	23	53.0
3	2 thru 3	44	60.5	41	59.2
6	5 thru 6	60	65.5	36	63.2
9	8 thru 9	42	69.5	36	68.1
12	11 thru 12	59	72.5	42	70.9
15	14 thru 15	39	75.2	32	74.3
18	17 thru 18	35	79.0	47	76.5
24	21 thru 26	162	83.0	119	82.0

These averages were roughly equivalent to those obtained by Woodbury (1921) for Negro infants measured the same year.

Sawtell, Ruth Otis. **1929** Ossification and growth of children from one to eight years of age. *Amer. J. Dis. Child.,* 37, 61-87.

Analysis was made of data for recumbent stature, collected 1925-27 at the nursery school of the Bureau of Educational Experiments, New York City. With reference to "racial and environmental factors," the sample was considered "typical of a private school in a large American city" (p. 61). The majority of the homes were "in the Chelsea or Greenwich Village section of New York" and represented "moderate prosperity rather than wealth" (pp. 61-62).

STATURE (cm.) OF NEW YORK "PRIVATE SCHOOL" INFANTS EXAMINED 1925-27

Age Group		*Males*			*Females*		
Midpoint	Range (mos.)	Number	Mean	S.D.	Number	Mean	S.D.
12	6 thru 17	10	76.0	5.80	7	75.2	3.17
24	18 thru 29	11	91.1	2.98	11	87.2	3.44

Except for the males in the two-year age group, the mean age of each subsample was within one-half month of its age-group midpoint. The mean age of the 11 males in the two-year age group was 25.7 months. Graphic interpolation, employing a plot of the two male stature means as ordinate values and their corresponding age means as abscissa values, gave a mean stature at twenty-four months of approximately 89.5 cm.

Schwarz, Herman and **Kohn,** Jerome L. **1921** The infant of low birth weight; its growth and development. *Amer. J. Dis. Child.*, 21, 296-306.

Measurements of stature at ages six months and one year were secured on infants weighing less than 2400 gm. at birth. Subjects: 43 infants "delivered in their homes" and given free supervision during the first postnatal year by the John E. Berwind Maternity Clinic, New York. The investigators noted that a given new-born weighing less than 2400 gm. may have been a) "born prematurely," b) "one of twins," or c) "full term" from a single pregnancy.

STATURE (cm.) AT SIX MONTHS AND ONE YEAR FOR INFANTS OF LOW BIRTH WEIGHT

Birth Weight (gm.)	Pregnancy	*6 mos.*		*12 mos.*	
		Number	Mean	Number	Mean
2000-2400	Single	11	61.1	27	68.2
2000-2400	Twin	6	59.3	11	67.2
1440-1920	Single and Twin	1	55.0	4	63.8
990	Single and Twin	1	34.4	1	60.9

For the five cases weighing less than 2000 gm. at birth, "length at one year was never more than 64 cm." (p. 302). Although the stature means for those with birth weights between 2000 gm. and 2400 gm. were appreciably higher, it was concluded that the "impulse to grow in length" was "not strong enough to overcome the handicap at birth" (p. 304).

Shinn, Milicent Washburn. **1893** Notes on the development of a child. *Univ. Calif. Studies,* 1, Nos. 1 and 2. Pp. 178.

Seriatim stature measurements taken on a single female infant were reported. Ancestry: American, "all four grandparents being descended from early colonists" (p. 5). Postnatal history: Born and reared "on a fruit ranch near Niles, in the neighborhood of San Francisco Bay . . . The conditions of climate and opportunities for outdoor life being singularly favorable" (p. 5). Stature was measured recumbent throughout the first year, erect "against the wall" during the second year. Records were secured at monthly intervals, several determinations being made at each examination.

STATURE (cm.) OF CALIFORNIA FEMALE INFANT

Birth	3 mos.	6 mos.	12 mos.		18 mos.	24 mos.
			Recumbent	*Erect*		
48.3	58.4	63.5	72.2	71.1	78.7	83.8

Stature at one year of age was greater in the recumbent than in the erect position. Stature at two years exceeded stature at birth by 35.5 cm., or 73.5 per cent.

Simmons, Katherine and **Todd,** T. Wingate. **1938** Growth of well children: Analysis of stature and weight, 3 months to 13 years. *Growth,* 2, 93-134.

Utilizing stature measurements obtained from serial examination of 406 infants of "the economically stable, more intelligent and cooperative families of Cleveland and its suburbs," Simmons and Todd presented figures for absolute magnitude, absolute increase, change in rank, and association between size and gain. Subjects: Healthy infants "under intelligent parental guidance and efficient medical supervision" (p. 94)—"as well cared for and as uniformly nourished as any group likely to be drawn from the extra-institutional population" (p. 128). Parents: "With few exceptions, ultimately of North European ancestry''; 80 per cent ''engaged in professional and business executive positions,'' 20 per cent ''in commercial and managerial occupations''; willing to participate voluntarily in ''a long term program of remeasurement'' (p. 97). Data: 968 stature values on 207 males and 898 values on 199 females; collected at birth by the Maternity Hospital and at three, six, nine, twelve, eighteen and twenty-four months by the Developmental Health Inquiry, Western Reserve University; amassed between 1931 and 1937. Stature was taken in the recumbent position throughout the first year and erect, though ''not against a wall,'' at later ages. All measurements were made ''within seven days'' of the quarterly and semi-annual examination ages.

STATURE (cm.) OF CLEVELAND INFANTS OF "A SELECT AND HIGHLY COOPERATIVE CLASS"

Absolute size and gain

Age	Males				Females			
(mos.)	N	Mean	S.D.	V	N	Mean	S.D.	V
				Size at successive ages				
Birth	70	50.1	2.70	5.4	47	49.5	2.34	4.7
3	137	61.3	1.54	2.5	116	59.3	2.16	3.6
6	147	67.2	2.30	3.4	132	65.6	2.27	3.5
9	151	72.0	2.25	3.1	141	70.3	2.62	3.7
12	154	76.1	2.63	3.5	148	74.2	2.85	3.8
18	152	82.2	3.01	3.7	149	80.6	3.06	3.8
24	157	87.4	3.22	3.7	165	86.2	3.15	3.7
				Increment between selected ages				
3 to 12	101	15.0	1.82	12.1	87	15.0	1.89	12.6
12 to 24	49	12.4	1.25	10.1	44	13.2	1.81	13.7

Change in rank

Correlation coefficients for five paired ages:

Sex	Birth with 3 mos.		Birth with 12 mos.		3 mos. with 12 mos.		3 mos. with 24 mos.		12 mos. with 24 mos.	
	N	*r*	N	*r*	N	*r*	N	*r*	N	*r*
Males	58	.56	62	.40	104	.66	101	.61	49	.88
Females	38	.53	41	.30	99	.72	98	.72	44	.83

Change of position in distribution from three months to two years:

	Number measured at both ages	Remaining in: Highest quarter		Lowest quarter		Shifting from: Highest to lowest quarter		Lowest to highest quarter	
		N	%	N	%	N	%	N	%
Males	99	13	52	13	52	2	8	4	16
Females	92	13	57	15	65	2	9	0	0

Association between size and gain

Correlation of magnitude at three ages with increment for ensuing periods:

Magnitude		Increment	Males N	Males r	Females N	Females r
Birth	with	birth to 12 mos.	64	−.46	41	−.01
3 mos.	with	3 to 12 mos.	104	−.20	99	−.05
12 mos.	with	12 to 24 mos.	61	.20	57	.06

Mean gain of infants in upper and lower quarters of the distribution at three months:

Position at 3 mos.	3 to 6 mos. Males	3 to 6 mos. Females	3 to 12 mos. Males	3 to 12 mos. Females	3 to 24 mos. Males	3 to 24 mos. Females
Highest quarter	5.7	5.7	14.1	14.9	26.3	27.0
Lowest quarter	6.8	6.4	15.8	14.8	27.3	26.5

Findings: 1) Mean stature throughout was practically equivalent to that reported by Stuart (1934) on Boston infants mainly of the middle classes; 2) mean gain in stature was appreciably greater for the period from three months to one year than for the entire second year; 3) the correlation between stature at birth and at one year of around .35 was markedly lower than that between stature at one and two years; 4) over the interval between three months and two years a few infants shifted their rank in the group through most of the range—moving from among the highest quarter through the middle one-half, into the lowest quarter, and vice versa; 5) during the first year males gave a negative relationship for absolute stature with gain in stature, females gave coefficients of near zero for both the first and second years; 6) the mean gain between three and six months was less for male and female infants above the 75th percentile at three months than for those below the 25th percentile at this age, males and females among the upper and lower one-fourth at three months showed no consistent difference in mean gain between this age and two years.

Slyker, Francis; **Hamil,** Brenton M.; **Poole,** Marsh W.; **Cooley,** Thomas B. and **Macy,** Icie G. **1937** Relationship between vitamin D intake and linear growth in infants. *Proc. Soc. exp. Biol. and Med.,* 37, 499-502.

The relationship in early infancy between vitamin D intake and gain in stature was investigated. Subjects: 414 Detroit infants of the "indigent or near-indigent class" followed from the first, second, or third postnatal month "to the end of their first year of life'' (p. 500). Rejections: ''Infants whose family background predisposed to defect and infants presented for initial examination after reaching 10 weeks of age'' (p. 500). Data: Accumulated over a three-year period by the Research Laboratory of Children's Fund of Michigan and Children's Hospital of Michigan. Diet: ''A carefully balanced artificial diet was prescribed, based on evaporated milk, and the chief elements supplied gratis to the parents. A daily supply of vitamin C considered adequate was supplied by commercial dehydrated lemon juice powder . . . Carbohydrates were added in the form of Karo syrup. Solids were added to the diet at suitable ages'' (p. 500). Subgroups: 281 infants were prescribed cod liver oil in dosages to yield 250 to 810 U.S.P. units of vitamin D daily (average intake estimated at approximately 650 U.S.P. units), 76 infants were given irradiated evaporated milk affording 95 to 152 U.S.P. units per day, and 57 infants were given no supplemental vitamin D prior to eight months and a high dosage of cod liver oil between eight and twelve months. Each group was considered equivalent for sex and ethnic origin.

STATURE (cm.) OF DETROIT INFANTS ON SUPERVISED DIETS

Group	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.
Cod liver oil	54.2	60.3	66.9	72.0	75.6
Irradiated milk	54.0	59.9	66.3	71.3	74.2
Late supplementary vitamin D	54.2	59.8	65.3	70 3	73.2

The average gain between one month and one year, determined as the difference between the means at these ages, was 21.4 cm. for the high vitamin D group, 20.2 cm. for the moderate vitamin D group, and 19.0 cm. for the group receiving no supplemental vitamin D before the age of eight months. Note: The means at the ''end'' of the year were presented as representing approximately 355 days.

Sontag, Lester Warren. **1940** Effect of fetal activity on the nutritional state of the infant at birth. *Amer. J. Dis. Child.*, 60, 621-630.

Included in this reference were records of stature for two White neonates, "born at term", to mothers who had undergone severe and prolonged emotional disturbance during pregnancy. Mother of Infant A: Age thirty-three, stature 152.0 cm., physical condition "good." "She was of a rather nervous temperament and was easily disturbed. The father of the child had concealed from her the fact that he already had a wife and family until after she had become pregnant. Her background was strongly religious and moralistic, and she had a highly developed sense of her responsibility to the child. Coupled with this situation was the fact that she was under the care of an elderly woman who constantly made life miserable for her because of the difficulty she had got herself into. The product of this situation was a state of almost continual emotional turbulence" (p. 628). Mother of Infant B: Age twenty-five, in "good" physical condition. "She and her husband were both college graduates. Her husband had shown previous indications of a not too stable emotional constitution, and during the fifth month of his wife's pregnancy he displayed definite manic symptoms. He became more or less constantly irritated at his wife and struck her on several occasions. During the balance of the pregnancy his condition was worse. The wife lived in constant apprehension of physical violence and, since they had little financial reserve, was, in addition, faced with the problem of providing for the care of a newcomer in the family, as well as with deciding what course to pursue in regard to her husband's psychosis. On several occasions when her husband became quarrelsome and threatened her, she left her home for the night and sought refuge with friends" (pp. 628-9). Stature at birth was 46.8 cm. for A and 52.0 for B.

Stearns, Genevieve; **Jeans,** Philip C.; **Catherwood,** Ruth and **McKinley,** John B. **1941** Diet in malnutrition and celiac disease. *J. Pediat.*, 18, 12-30.

Stature data were incorporated on a single male infant under treatment for celiac disease. Subject: Born June, 1934; when examined at the age of eighteen months had a recumbent stature of 79.4 cm. On the assumption that "The malnutrition of celiac disease is known to be associated with impaired utilization of fats and complex carbohydrates but with good utilization of protein," the case was placed on a diet high in protein, mineral and vitamin content, as low as practicable in fat, and with bananas as the main source of carbohydrate. Over a period of approximately eighty days the gain in recumbent stature was 3.1 cm.

Stearns, Genevieve; **Jeans,** Philip C. and **Vandecar,** Vera. **1936**
The effect of vitamin D on linear growth in infancy. *J. Pediat.,* 9, 1-10.

Results were presented from a study of the relationship between amount of vitamin D intake and growth in stature during the first year of postnatal life. The data were accumulated between 1930 and 1936 on 47 "well male infants" especially housed for research on mineral metabolism with the Department of Pediatrics, University Hospitals, Iowa City. Subgroups: The subjects were segregated on the basis of vitamin D intake into a "high" group and two "moderate" groups. The former—consisting of 36 male infants "given the equivalent of one teaspoonful of cod liver oil daily (340 to 400 U.S.P. units of vitamin D) "—increased in average stature from 52.3 cm. at three weeks to 77.0 cm. at forty-eight weeks. One of the "moderate intake" groups—seven male infants "given irradiated milk or its vitamin D equivalent as cod liver oil or cod liver oil milk concentrate, ingesting from 60 to 135 U.S.P. units of vitamin D daily" (p. 4)—averaged 53.8 cm. at three weeks and 64.8 cm. at eighteen weeks. The remaining "moderate intake" group—four male infants "given irradiated milk (60 to 135 U.S.P. units of vitamin D daily)—averaged 53.6 cm. at five weeks and 70.0 cm. at thirty-four weeks. Nursery care, freedom from illness, and type of feeding (except for vitamin D intake) were considered equivalent for all groups. Graphic alignment of the curves of central tendency for each group gave parallel trends for the two groups receiving moderate amounts of vitamin D, while the line representing the group given the larger amount of vitamin D registered a more accelerated growth rate. The averages at three, six and nine months for the group fed 340-400 U.S.P.

units of vitamin D daily, and at three and six months for the group given 60-135 U.S.P. units of vitamin D daily in the form of irradiated milk, are reproduced below.

STATURE (cm.) OF MALE INFANTS FOR TWO LEVELS OF VITAMIN D INTAKE

Vitamin D Dosage	3 mos.		6 mos.		9 mos.	
(U.S.P. units)	N	Av.	N	Av.	N	Av.
340-400	35	60.3	21	68.3	14	73.2
60-135	4	59.3	4	67.1		

Over the period from seven to sixteen weeks of age, increments for individuals showed: "The most rapid growth . . . in the high vitamin D group was 7.4 cm., the lowest 6.1 cm. . . . The moderate vitamin D groups varied from 6.8 to 3.5 cm." (p. 9). For the last third of the year, comparison of the averages for the "high" vitamin D group with all averages at like ages previously reported indicated the former to be equalled by Freeman's (1914) series followed in private pediatric practice and to be surpassed only by the "controlled diet" studies of Nelson (1930) and of Jeans and Stearns (1936). The marked stature growth of this group was ascribed "chiefly to the increased intake of vitamin D," which, "through its effect on mineral retentions, increased the amount of calcium salts available for the formation of new bone" (p. 5). In support of this interpretation the observation was made that where milk intake was the same, "the average quantities of calcium and phosphorus actually retained daily by the infants given one teaspoonful of cod liver oil a day were significantly greater than the mean daily retentions of calcium and phosphorus by infants given the moderate intake of vitamin D" (p. 5).

Included in this paper was a single curve to show "the effect of illness" on growth in stature during infancy. Subject: A male infant, fifth-born, of Scandinavian stock, "born of a mother with nephritis," about average in length and weight when admitted to metabolism ward at 7.5 weeks. His stature curve showed two ~~to~~ deflections, one around twenty-five weeks of age, the period of a mild chicken pox infection, and the second following forty weeks of age, the period of "a severe illness, a laryngitis requiring tracheotomy, wherein the child was critically ill for a period of several days and moderately ill for a month or more'' (p. 8). Notwithstanding these illnesses and the fact that the child was ''always unusualy susceptible to respiratory infection,'' gain in stature between 7.5 weeks and one year was reported to have been 5.0 cm. more than average.

Stebbins, Theodora H. **1933** A nutritional index of new-born infants. Unpublished master's thesis, Univ. Ia.

Vertex-heel length was determined on 100 full-term neonates born at the University Hospitals, Iowa City, during February and March, 1933. Each subject was measured on the second day (24 to 48 hours after birth) and again on the ninth day. No subject weighed less than 2500 gm. at birth. Parents: ''white, American,'' below average in socio-economic status.

STATURE (cm.) OF IOWA NEONATES OF LOWER CLASSES

Age (days)	Sex	Number	Mean	S.D.	V	Percentiles 25th	Percentiles 75th	Range
2	Males	50	50.2	1.82	3.6	48.8	51.5	46.9-54.5
9	Males	50	51.3	1.80	3.5	50.0	52.7	47.6-56.4
2	Females	50	49.2	1.52	3.1	48.2	50.2	45.6-51.9
9	Females	50	50.2	1.47	2.9	49.2	51.3	47.1-52.5

Comparable central tendency and variability values were higher for males than females. The mean for females aged nine days equalled that for males aged two days. At both ages, 50 per cent of the male records fell within a zone of 2.7 cm. and 50 per cent of the females within the zone of 2.1 cm.

Stockton-Hough, John. **1885** Statistics relating to seven hundred births (White) occurring in the Philadelphia Hospital (Blockley) between 1865 and 1872. *Philadelphia Medical Times*, 16, 92-94.

An analysis of records for ''entire length'' on neonates born during the years 1865 to 1872 was reported. Data: Accumulated at the Philadelphia Hospital (Blockley) on 712 newborn White infants; subgrouped for analysis by sex and "number of pregnancy." No statements were made on exclusions (e.g., disposition of premature and multiple birth records) or on the socio-economic composition of the sample.

STATURE (cm.) OF PHILADELPHIA INFANTS AT BIRTH

	Males		*Females*	
	Number	Average	Number	Average
Total Cases	330	49.4	382	48.3
Pregnancy Order:				
First	207	49.1	216	47.8
Second	61	49.9	95	49.0
Third	22	50.7	24	49.1
Fourth to Tenth	40	49.0	47	48.7

Average stature was greater for newborn males than females, and greater for neonates from second and third pregnancies than from first.

Stuart, Harold C. **1934** Standards of physical development for reference in clinical appraisement. *J. Pediat.*, 5, 194-209. (See also, *Monogr. Soc. Res. Child Developm.* 1939, 4, No. 1. Pp. 261.)

An analysis was presented of data for recumbent stature obtained on 119 White infants each measured one to eight times at ages between birth and two years. Data: Collected 1930-34 by the anthropometric staff of the Center for Research in Child Health and Development, Harvard University. Subjects: Born at the Boston Lying-in Hospital; all of American or North European parentage—roughly half of Irish descent; none "sick or clinically abnormal" or weighing less than "5 pounds at birth" (p. 199). Fathers: About 30 per cent unskilled or semiskilled, 50 per cent skilled, and 20 per cent of managerial or professional classes. The examinations included comprehensive medical evaluations and afforded parents both general and individualized "advice as to feeding and care" (p. 31). The "accepted immunizations" were "carried out at the appropriate ages" (p. 28). At each examination stature was taken by two anthropometrists: If their measurements agreed within 0.5 cm. "the median" was taken, otherwise another two measurements were obtained and "the median" of the four recorded.

STATURE (cm.) OF BOSTON MIDDLE CLASS, CLINIC SUPERVISED INFANTS

Age Group					Percentiles				
Midpoint	Range	N	Mean	S.D.	10th	25th	75th	90th	Range
			Males						
Birth	0 to 48 hrs.	50	50.5	2.1	47.7	49.2	52.2	52.9	45.0-54.4
2 wks.	12 thru 14 days	33	52.1	2.0	49.2	51.1	53.5	54.7	47.0-55.6
3 mos.	12 thru 13 wks.	50	60.8	2.0	58.2	59.1	62.2	63.5	57.2-66.4
6 mos.	25 thru 26 wks.	44	67.1	2.0	64.4	65.6	69.0	70.2	62.3-70.5
9 mos.	38 thru 39 wks.	42	71.5	2.1	68.8	70.1	73.0	74.9	68.0-76.0
12 mos.	51 thru 52 wks.	38	75.7	2.6	72.4	73.7	77.6	79.4	71.8-81.1
18 mos.	77 thru 78 wks.	34	82.4	2.6	79.1	80.5	83.9	85.5	78.9-90.0
24 mos.	103 thru 104 wks.	26	88.5	2.8	84.6	86.2	90.4	91.7	83.5-96.7
			Females						
Birth	0 to 48 hrs.	63	50.0	2.0	47.2	48.8	51.0	52.2	45.6-55.6
2 wks.	12 thru 14 days	50	51.5	2.3	48.5	49.9	52.8	54.0	46.8-58.6
3 mos.	12 thru 13 wks.	69	59.2	2.0	56.4	57.8	60.7	61.8	54.4-65.0
6 mos.	25 thru 26 wks.	58	65.3	2.1	62.4	63.8	66.8	68.2	59.4-69.8
9 mos.	38 thru 39 wks.	54	70.0	2.2	67.0	68.4	71.8	73.2	64.8-75.0
12 mos.	51 thru 52 wks.	49	73.9	2.6	70.3	72.3	75.8	77.8	68.6-79.0
18 mos.	77 thru 78 wks.	44	81.2	2.8	77.6	79.5	83.1	85.0	74.0-87.0
24 mos.	103 thru 104 wks.	31	86.1	2.9	82.0	84.6	88.1	89.7	80.0-92.2

The means at one year of age were similar to those of Bakwin, Bakwin and Milgram (1934) for New York City infants supervised through the clinic of Bellevue Hospital. They were around one centimeter lower than for the infants of the Fifth Avenue Hospital clinic. At two years of age, compared with the lowest means previously recorded, Stuart's means were higher by 5.7 cm. for males and 4.1 cm. for females. For instances of means at two years higher than those of Stuart by more than a centimeter, see Table IXb of the appendix.

Stuart, Harold C. **1939** Studies from the Center for Research in Child Health and Development, School of Public Health, Harvard University: I. The Center, the group under observation, sources of information, and studies in progress. *Monogr. Soc. Res. Child Developm.*, 4, No. 1. Pp. xiv, 261.

Seriatim stature data were incorporated on six related infants—

one male and two females born to each of two sisters. Background of infants of family A: Maternal grandparents born and educated in southern Ireland, economically of the lower middle classes; paternal grandparents of French descent, American-born, and of middle classes; parents born in Massachusetts, free from "hereditary" or "familial" diseases, mother "a short woman," father of "average height," mother a high school graduate with some secretarial experience, father a draftsman with two years each of engineeering and architecture beyond high school; mother's diet during her first two pregnancies was "unsatisfactory in its content of protein, calcium, iron and vitamins . . . excessive in carbohydrates" (p. 149), during the third pregnancy her diet was "slightly improved in some respects" (p. 157).

Background of infants of family B: Maternal grandparents same as for family A; paternal grandparents of southern Irish descent, American-born, and of upper middle classes; parents born in Massachusetts, from sound and healthy stocks, mother a "tall" woman ("five feet six inches in height") and father "in the upper quartile for men," mother a high school graduate with evening business training and secretarial experience, father with a brokerage firm since high school plus a business college course—classified among the "professional group"; mother's diet excellent during second and third pregnancies but until the seventh month of the first pregnancy "somewhat below the level generally accepted as optimum . . . in calcium, iron and certain of the vitamins" (p. 179).

Subjects: Three infants each of families A and B; all born at the Boston Lying-in Hospital and periodically examined at the Center for Research in Child Health and Development, Harvard University; full-term, normal infants; reasonably healthy during infancy and "unusually free from the customary minor illnesses" (p. 148); sleep, sunshine and outdoor play were "adequate" and the total "environment and care" in both families "satisfactory" (p. 208).

Infants of family A: A-1, first-born, male; "nursed poorly," received cod liver oil daily beginning "sometime before the three months' examination," during the period from three to nine months the "diet contained very little food which contributed markedly toward meeting requirements for iron," from eighteen to twenty-four months the diet was generally "poor" (p. 150); had "a mild facial eczema and seborrhea of the scalp'' at two months, ''a mild gastrointestinal upset'' in the twelfth month, and ''mild and uncomplicated'' whooping cough at twenty-two months; ''immunized against diphtheria'' between six and nine months, ''had a successful vaccination 'take' at nine months'' (p. 150). A-2, second-born, female; ''vitamin D supplement was started early,'' iron intake considered inadequate during first year, in twelfth month ''small daily doses of ferric ammonium citrate'' were given; on the whole, diet was ''fair to good'' (pp. 154-155); had an abdominal operation the fourth day, moderate secondary anemia during the early postnatal months, mild whooping cough with some vomiting in seventh month, and returning evidences of hypochromic anemia during the latter half of the first year; was ''successfully immunized against diphtheria'' between nine months and one year, also ''vaccination at eleven months resulted in a satisfactory 'take' '' (p. 154). A-3, third-born, female; during first year diet was ''good except for unsatisfactory provisions of food with adequate content of iron,'' in the second year the diet dropped in quality ''due to replacement of part of milk with excessive amounts of carbohydrate'' (p. 157); had ''no illness other than infrequent colds or mild upper respiratory infections'' (p. 157); immunized against diphtheria at nine months and ''successfully vaccinated at twenty-three months'' (p. 157). On the whole the diet of A-3 was superior to that of A-1 and comparable to that of A-2 during the first year. During the second year it was comparable to that of A-1 and inferior to that of A-2.

Infants of family B: B-1, first-born, male; in general, diet was ''good,'' ''accessory sources of vitamins A, C and D were introduced during the second month,'' iron was the only food substance frequently provided in ''less than optimum amounts'' (p. 181); had ''no significant illnesses''; was immunized against diphtheria at nine months . . . successfully vaccinated at twelve months'' (p. 180). B-2, second-born, female; diet was ''entirely adequate'' to three months, fairly low in sources of iron between three months and one year, good to excellent during the second year; had ''a slight conjunctival discharge during the early months . . . 'Hives' were noted on a few occasions during the second year and were on two occasions accompanied by vomiting'' (p. 184); immunized against diphtheria at nine months and ''vaccinated against smallpox at one year'' (p. 184). B-3, third-born, female; orange juice and cod liver oil were added to breast feeding at two weeks, soft solids were "introduced early and in liberal amounts . . . no illness" (p. 186). The infants of the B family "received better diets than their cousins" and also had taller parents.

STATURE OF SIX BOSTON INFANTS STUDIED BETWEEN 1931 AND 1938

	Birth	3 mos.	6 mos.	9 mos.	12 mos.	18 mos.	24 mos.
			Absolute stature (cm.)				
Family A:							
A-1, male	47.0	56.5	62.3	67.7	72.8	80.8	83.7
A-2, female		56.8	63.3	67.8	71.2	77.5	83.2
A-3, female	49.7	59.0	64.6	68.8	72.7	78.5	84.0
Family B (first cousins):							
B-1, male	51.7	61.7	67.8	72.5	77.3	84.3	90.5
B-2, female	53.7	61.8	68.0	72.6	76.6	84.7	89.6
B-3, female	50.7	60.2	66.7				
			Percentile rank				
Family A:							
A-1, male	5	1	1	1	8	23	5
A-2, female		15	19	21	16	17	21
A-3, female	27	42	30	26	28	21	23
Family B:							
B-1, male	67	73	66	64	73	79	86
B-2, female	99	86	81	77	76	83	77
B-3, female	64	62	68	57			

At every age, each of the three infants of family B was taller than any cousin of family A (as previously noted, the infants of family A had both shorter parents and "distinctly poorer diets"). Referred to the larger sample studied by Stuart (1934), the three infants of family B were all above average and those of family A below average. Considered together, the six infants distributed themselves over practically the entire stature range of the larger sample—from definitely "tall" (B-2), through "above average" and "below average" (B-3 and A-3 respectively), to decidedly "short" (A-1). A-2 came nearest to maintaining a constant position in the stature distributions for successive ages, while changes in percentile rank of more than twenty points were registered for A-1, A-3, B-1 and B-2.

Swanson, Roy Edwin. **1926** The growth of the human female pelvis from birth to maturity: A graphic and quantitative study. Unpublished doctoral dissertation, Univ. Minn. Pp. 198.

Stature means at one week following birth and at one and two years of age were presented. Subjects: 120 White, full-term, "healthy normal" females examined 1924-25 in Minneapolis and St. Paul, Minnesota. Parents: Mainly "middle class" and of British, Scandinavian, and German descent. Stature was taken with the subjects in dorsal recumbency prior to one year, and erect at later ages.

STATURE (cm.) OF "TWIN CITIES" FEMALE INFANTS OF MIDDLE CLASSES

7 days		12 mos.		24 mos.	
Number	Mean	Number	Mean	Number	Mean
30	50.8	45	71.8	45	83.3

The mean for one year exceeded the mean for one week by 21 cm. (41 per cent), and was exceeded by the mean for two years to the extent of 11.5 cm. (16 per cent).

Swanson, William W.; **Lennarson,** Vernon E. and **Adair,** Fred L. **1936** The premature infant. *J. Pediat.*, 9, 11-16.

In 10,660 unselected consecutive births at the Chicago Lying-in Hospital during the years 1931-35, these authors found vertex-heel length to be under 47.0 cm. for 678 cases, or 6.4 per cent. Of the 10,423 cases weighing more than 2000 gm. at birth, lengths below 47.0 cm. were obtained for 442 or 4.2 per cent; of the 10,005 cases with birth weights exceeding 2500 gm., 97 or 1.0 per cent were below 47.0 cm.

Talbot, Fritz B. **1924** Studies in growth: II. Growth of premature infants. *Amer. J. Dis. Child.*, 27, 550-555. (See also, Talbot, Fritz B., Sisson, Warren R., Moriarty, Margaret E., and Dalrymple, Alice J. 1923 The basal metabolism of prematurity: III. Metabolism findings in twenty-one premature infants. *Amer. J. Dis. Child.*, 26, 29-55.)

Thirty measurements of stature were collected on twenty infants "from four to ten weeks premature" (p. 30). "The criteria used in establishing prematurity were weight, length, and general considerations, such as facies, texture of the skin, undeveloped nails, cry, unstable temperature and history of expected birth" (p. 30). Subjects: 10 males and 10 females, born 1920-22, housed at the Boston Lying-In Hospital and the Children's Department of the Massachusetts General Hospital, all "organically sound" (p. 30). The postnatal age range of the infants when measured extended from seven days to seventeen months. Twelve were measured once, seven twice, and one at five ages.

STATURE OF PREMATURE INFANTS AT POSTNATAL AGES
7 TO 45 DAYS

Age Group Mean (days)	Age Group Range (days)	Number	Weight Mean (grams)	Weight Range (grams)	Stature Mean (cm.)	Stature Range (cm.)
12	7-18	10	1660	1304-2098	43.1	38.0-46.5
30	21-45	13	1857	1191-2339	45.1	38.0-47.7

The subject measured on five successive occasions—a female—had stature records of 43.8 cm. at two weeks, 47.0 cm. at 2.2 months, 53.0 cm. at 3.2 months, 68.7 cm. at fourteen months, and 69.8 cm. at seventeen months. Only one other record was obtained at a postnatal age above three months; this was a single measurement of 81.0 cm. for a male infant at sixteen months.

Taylor, Rood. **1919** The measurements of 250 full-term, new-born infants. *Amer. J. Dis. Child.,* 17, 353-362.

Taylor obtained "total length from vertex to sole" on 250 neonates born between 1914 and 1917. The measurements were made at the University Hospital, Minneapolis—a charity hospital admitting primiparous women almost exclusively. "Eighty-one per cent of the babies were measured on the fourth, fifth, or sixth day of life, none earlier than the second, and none later than the tenth" (p. 353). Infants: All "normal and born at term" (p. 353). Mothers: Roughly four-fifths of northwest European ancestry, one-tenth Jewish.

STATURE (cm.) OF MINNEAPOLIS NEONATES, PREDOMINANTLY FIRST-BORN

	Age (approx.)	Number	Mean	S.D.	V	Range
Males	5 days	125	51.2	2.10	4.1	45.2-57.0
Females	5 days	125	50.0	2.05	4.1	45.0-56.6

In mean stature males exceeded females. In variability of stature the two sexes were similar. The standard deviations and coefficients of variation were appreciably smaller than those from the Montague and Hollingworth (1914) study.

Tiber, Leon J. **1930** Changes in body size during the first ten days of postnatal life, with particular reference to birth molding. Unpublished doctoral dissertation, Univ. of Minn. Pp. 310.

Employing a series of "mature, healthy, Caucasian babies," Tiber measured vertex-heel length within six hours after birth and again at the end of the first postnatal week. Subjects: 208 neonates "delivered at the obstetrical department of the Ancker Hospital of St. Paul, Minnesota, in the winter of 1928-29" (p. 32). Mothers: One-third primiparae, two-thirds between eighteen and twenty-eight years of age, four-fifths of northwest European stocks.

STATURE (cm.) OF NEONATES BORN AT ST. PAUL 1928-29

	Males				*Females*			
Age	N	Median	Percentiles		N	Median	Percentiles	
			25th	75th			25th	75th
Birth	106	50.8	49.6	52.3	102	49.8	48.7	50.9
7 days	106	51.6	50.0	52.9	102	50.4	49.4	51.4

The study at birth by Montague and Hollingworth (1914) yielded similar values for central tendency, but gave zones embracing the middle one-half of the cases that were larger by 1.0 cm. Richdorf's (1925) study at one week differed from Tiber's in yielding a higher central tendency value for females, and somewhat smaller differences between the boundary values of the central 50 per cent for both sexes.

Wallis, Ruth Sawtell. **1931** How children grow: An anthropometric study of private school children from two to eight years of age. *Univ. Ia. Stud. Child Welf.*, 5, No. 1, Pp. 137.

Stature measurements on 82 infants between six and thirty months of age were secured through two New York City private schools. Subjects: In attendance at the nursery schools of the Bureau of Educational Experiments and Institute of Child Development of Columbia University, on the waiting lists of these schools, or "younger brothers and sisters of those attending" (p. 9). Ancestry: Nine-tenths of the subjects had American-born parents; for over one-half, all grandparents were American-born. Socio-economic status: The sample was considered representative of "the favored class whose economic environment offers them the possibility of attaining the maximum growth inherent in their family lines" (p. 12). Stature was measured "while the child reclined on a board" and "repeated until agreement was reached at two consecutive readings" (p. 23). The data were collected 1924-29.

STATURE (cm.) OF NEW YORK "PRIVATE SCHOOL" INFANTS EXAMINED 1924-29

Age Group Midpoint	Age Group Range (mos.)	*Males* N	*Males* Mean	*Males* S.D.	*Males* Range	*Females* N	*Females* Mean	*Females* S.D.	*Females* Range
12	6 thru 17	21	75.2	4.80	66-84	15	75.4	5.28	64-87
24	18 thru 29	24	89.9	3.46	80-96	22	86.7	2.67	83-92

At one year, the mean for each sex was identical with that reported by Gray and Ayres (1931). At two years, the mean for males was unsurpassed in earlier studies, while that for females was slightly lower than that reported from the Merrill-Palmer nursery school (Wilson, Sweeny, Stutsman, Chesire and Hatt, 1930).

White, Priscilla. **1932** *Diabetes in childhood and adolescence.* Philadelphia: Lea and Febiger. Pp. 236.

In this study of diabetic children extending over the age period from one year to adulthood, White included figures for stature at one and two years. The onset of diabetes for different subjects occurred between 1926 and 1931. The length of time the cases had been under treatment when measured was not made explicit.

STATURE (cm.) OF DIABETIC INFANTS

12 mos.		*24 mos.*	
Number	Record	Number	Average
1	74.4	5	97.8

It appears probable that the mean at two years is an erroneous value. This follows since it is markedly higher than any other mean at two years reported (see Table IXa of the appendix), and also higher by 3.8 cm. than the figure given by White for age three years.

Wilcox, Daniel A. **1936** A study of three hundred and thirty premature infants. *Amer. J. Dis. Child.*, 52, 848-862.

Records of stature on 250 new-borns with birth weights not exceeding 2500 gm. were subjected to analysis. The data were gathered between 1929 and 1934 from the public wards of the Sloane Hospital for Women, New York City. In 10,163 consecutive births, 330 infants weighed 2500 gm. or less, but for 80 stature was not taken. Of the 250 subjects, approximately two-thirds were White and one-third Negro, 42 per cent males and 58 per cent females, 20 per cent not over 1500 gm. at birth and 80 per cent 1500 to 2500 gm.

STATURE (cm.) OF 250 NEW YORK CITY NEW-BORNS WEIGHING 2500 GRAMS OR LESS

Under 37 cm.		37-40 cm.		40-43 cm.		43-46 cm.		Over 46 cm.	
N	%	N	%	N	%	N	%	N	%
14	5.6	25	10.0	61	24.4	146	58.4	4	1.6

Birth weights not exceeding 2500 gm. were found for 3.2 per cent of the total records. Swanson, Lennarson and Adair (1936), utilizing a sample of similar size, obtained birth weights of 2500 gm. or less for 6.1 per cent. Peckham (1938), employing records for upwards of 39,000 "consecutive viable deliveries" accumulated 1896-1936, reported birth weights of less than 2500 gm. for 7.0 per cent of the White infants and 13.1 per cent of the Negro infants.

Wilson, Charles A.; **Sweeny,** Mary E.; **Stutsman,** Rachel; **Chesire,** Leone E. and **Hatt,** Elise. **1930** *The Merrill-Palmer standards of physical and mental growth.* Detroit, Michigan: The Merrill-Palmer School. Pp. 121.

Percentile values were reported at approximately two years of age for stature erect and recumbent. The data were gathered 1922-29 at Merrill-Palmer School, Detroit. Subjects: White; native-born; three-fourths of American-born parentage. Socio-economic status: "All occupational and economic levels were represented, but the upper levels were predominant"—over two-fifths of the fathers were in the "professional group" and more than half of the mothers "had college training" (p. 9).

STATURE (cm.) OF DETROIT CHILDREN FROM "SUPERIOR HOMES"

Age Group Midpoint (mos.)	Age Group Range (mos.)	Position	Number	Median	Percentiles 25th	Percentiles 75th	Range
			Males				
24.5	21.5-27.5	Recumbent	29	88.4	86.7	90.0	81-96
24.5	21.5-27.5	Erect	29	87.9	86.1	89.5	80-94
			Females				
24.5	21.5-27.5	Recumbent	25	87.4	86.0	89.0	81-93
24.5	21.5-27.5	Erect	27	86.9	84.7	88.6	79-93

Typically, two-year-old children were found to have a stature 0.5 cm. greater when measured recumbent than when measured erect. The central tendency values approximated those reported by Baldwin (1921) for males—Freeman data—and by Sawtell (1929) for females.

Wise, Fairye C. **1941** The physical growth of Alabama White girls attending WPA preschools. Unpublished master's thesis, Univ. Ia.

Measurements of erect stature were obtained on 25 White females approximately two years of age attending WPA nursery schools and preschools in the vicinity of Birmingham, Alabama. Around 90 per cent of the parents and 85 per cent of the grandparents were born in Alabama or other parts of the southeastern region of the United States. The mean family income was $670, with more than 60 per cent of the fathers either employed as laborers or recipients of direct relief. At school, all of the children received one-half cup of fruit juice or milk daily and had at least one rest period, many were given cod liver oil and stayed for their mid-day meal and afternoon nap.

STATURE (cm.) OF ALABAMA WHITE FEMALES OF LOWER CLASSES MEASURED 1939-41

Age Group Midpoint	Age Group Range (mos.)	Number	Mean	S.D.	Range
24	21 thru 26	25	85.1	3.8	78.6-90.4

The mean was 2.1 cm. lower than the comparable mean from Meredith (1940) for Iowa City White females of the professional and managerial classes.

Wissler, Clark. **1911** Measurements of Dakota Indian children. *Annals, New York Academy of Sciences*, 20, 355-364.

Stature data were included for nine Dakota Indian infants of "full" and "mixed" blood. The infants were measured by Dr. J. R. Walker, physician in charge of the Pine Ridge Agency. Accurate information regarding the ages of the subjects was available since there was "enforced registration of all births" (p. 355). Full bloods: "chiefly of the Ogallala subdivision of the Teton, with an almost negligible mixture of Cheyenne" (p. 355). Mixed bloods: "due to white men marrying Indian women . . . include the offspring of all such unions even to the third degree" (p. 355).

STATURE (cm.) OF INFANTS OF OGALLALA DIVISION OF TETON INDIANS

	Full-Bloods				*Mixed-Bloods*	
Age	Males		Females		Males	
(mos.)	Number	Record	Number	Average	Number	Average
12	1	79.5			2	73.0
24	1	84.0	4	85.5	1	76.5

For "full" and "mixed" bloods together, the male average at one year (75.2 cm.) was higher than the Holt (1897) figure for White infants by 1.4 cm., and higher than the Hrdlicka (1908) Apache record by more than double this amount. At two years, and for both sexes combined, the average (83.8 cm.) was 1.0 cm.

above the Holt value and 4.1 cm. above the largest record from Hrdlicka for infants of the Pima tribe.

Wolf, Max and **Sherwin**, Carl P. **1923** The value of sweetened condensed milk as a food for babies. *Arch. Pediat.*, 40, 397-402.

Weekly measurements of stature covering a period of approximately six months were presented for each of three infants. The infants were artificially fed, one receiving "raw milk," one "pasteurized milk," and the third "sweetened condensed milk" supplemented with "orange juice to supply the necessary vitamin" (pp. 402, 399). Two cases were followed from two weeks after birth to six months, one from the eighth month to one year.

STATURE (cm.) OF THREE INFANTS FED DIFFERENT FORMS OF MILK

Subject	1 mo.	3 mos.	6 mos.	9 mos.	12 mos.
Raw milk	54.9	58.2	63.0		
Pasteurized milk				65.3	69.8
Condensed	53.8	56.1	58.2		

The subject receiving raw milk gained 8.1 cm. between ages one month and six months. Over the same age interval, the subject receiving sweetened condensed milk and orange juice gained only 4.4 cm. For both, "bone and tissue development appeared to be normal in every way" (p. 400). The infant registering the larger gain had one cold during the fourth month and recovered slowly. The infant yielding the smaller gain was free from illness during the entire period of the experiment.

Woodbury, Robert Morse. **1921** *Statures and weights of children under six years of age.* U. S. Dept. of Labor, Children's Bureau Publication, No. 87. Washington: Gov't Printing Office. P. 117.

This monograph reported an extensive analysis of stature data collected on White and Negro infants during the "Children's Year." Material: Upwards of 75,000 records "secured in 1918-19" through a national campaign promoted by "the Children's Bureau and the Woman's Committee of the Council of National Defense" (pp. 7, 9). These records were selected from three-fourths of a million returns on the basis of a) completeness and freedom from obviously erroneous information, b) stature having been measured "without shoes," c) lack of symptoms of sickness at time of examination, and d) "absence of physical defects" other than "carious teeth, diseased or enlarged tonsils, or adenoids" (p. 12). White subjects: Around 73,000 infants; approximately 47 per cent from New England, Middle Atlantic and east north-central states, 22 per cent from Iowa, 14 per cent from the "Western section" of the United States (including west north-central states, but excluding Iowa and California), 12 per cent from California and 5 per cent from southern states; about 70 per cent of the parents were American-born, with British and German stocks predominating, and moderate representation of Scandinavians, Italians, Czechs, and Jews. Negro subjects: 2582 infants, with approximately 52 per cent from southern states, 24 per cent from New York City, 16 per cent from New England, Middle Atlantic, and east north-central states, and the remaining 8 per cent from scattered regions.

The following tabulation for White infants was derived from the frequency distributions by sex and month of age afforded on pages 87-93 of Woodbury's report.

STATURE (cm.) OF WHITE INFANTS EXAMINED DURING THE "CHILDREN'S YEAR"

Age Group Midpoint	Age Group Range (mos.)	Number	Mean	S.D.	V	Percentiles 25th	Percentiles 75th	Range
				Males				
1	0 thru 2	2026	55.7	3.70	6.6	53.3	58.3	41-71
3	2 thru 3	3580	61.1	3.45	5.6	58.9	63.5	46-76
6	5 thru 6	3721	67.0	3.81	5.7	64.8	69.1	53-84
9	8 thru 9	3606	70.6	3.81	5.4	68.2	72.7	58-89
12	11 thru 12	3413	74.0	3.66	4.9	71.5	76.3	53-94
15	14 thru 15	2609	76.9	3.53	4.6	74.8	79.2	61-96
18	17 thru 18	2567	80.0	4.27	5.3	77.5	82.4	61-99
24	23 thru 24	2638	84.9	4.19	4.9	82.2	87.4	69-107
				Females				
1	0 thru 2	1903	54.4	3.60	6.6	52.1	56.8	41-71
3	2 thru 3	3466	59.8	3.38	5.6	57.6	62.0	46-74
6	5 thru 6	3517	65.4	3.94	6.0	62.9	67.3	53-84
9	8 thru 9	3546	69.2	3.81	5.5	66.8	71.2	56-89
12	11 thru 12	3063	72.4	3.73	5.2	70.1	74.6	56-91
15	14 thru 15	2560	75.4	3.66	4.9	73.0	77.5	58-96
18	17 thru 18	2447	78.7	4.24	5.4	76.0	81.0	61-94
24	23 thru 24	2484	83.4	4.04	4.8	80.8	85.9	69-104

Woodbury also gave means at birth for White infants; these were 53.2 cm. for 62 males and 54.7 cm. for 56 females. The finding that between birth and two years there was "a gradual slowing down in the rate of growth" was illustrated by noting that the amount of change in mean magnitude was as great during the period from one month to the middle of the first year as during the entire second year. Standard deviation and percentile figures showed the absolute zones "within which the bulk of the individual measurements fell" to be only slightly wider at two years than at three months. The Pearson variability coefficient tended to "decrease with age" (p. 21). Individual differences were such that the tallest infants examined at age one month equalled the shortest at age two years, and the tallest and shortest examined at age one year differed in stature by about thirty-five centimeters.

Supplementary analyses based upon portions of the "Children's Year" data treated stature differences for various ethnic groups, geographic regions, and physical defects. Four ethnic groups were considered, one Negro and three White. The White groups, formed by utilizing information on "birthplace of mother," consisted of "children from all parts of the country" whose mothers were reported born in Italy (half this group resided in New York City), Germany, and Scandinavia.

STATURE (cm.) OF INFANTS REPRESENTING FOUR ETHNIC GROUPS

Midpoint of Age Group (mos.)	*Scandinavian*		*German*		*Negro*		*Italian*	
	N	Mean	N	Mean	N	Mean	N	Mean
			Males					
3	82	63.2	81	60.8	152	59.6	469	59.4
6	100	67.7	74	67.2	130	65.2	394	65.1
9	76	71.6	68	70.8	110	68.4	345	69.3
12	80	74.2	84	73.8	85	71.4	276	72.0
15	55	77.4	58	77.3	53	75.2	221	75.1
18	61	81.1	60	80.0	71	78.1	217	78.1
24	189	86.1	170	85.1	184	82.9	582	82.2
			Females					
3	72	59.7	77	60.6	149	58.5	406	58.3
6	73	65.6	60	65.5	149	64.1	426	63.6
9	79	70.1	61	68.6	135	67.2	323	67.6
12	75	72.8	63	72.2	97	71.3	283	70.9
15	54	76.3	59	76.3	78	74.9	225	73.5
18	59	78.7	51	78.4	75	76.7	191	76.4
24	171	84.4	175	84.2	189	81.8	547	80.8

Mean stature throughout the period from three months to two years was less for infants of Italian and Negro descent than for infants of German-born mothers or of mothers born in Norway, Sweden, and Denmark. In interpreting this finding it should not be overlooked that the Italian and Negro groups probably represented somewhat lower socio-economic levels than the German and Scandinavian groups.

Subgrouping by geographic locality was carried out for White infants living in California, Iowa, and New York City. The percentages of parents native-born approximated 82 for Iowa, 62 for California, 23 for New York City.

STATURE (cm.) OF INFANTS OF THREE GEOGRAPHIC AREAS

Midpoint of Age Group (mos.)	*California* N	*California* Mean	*Iowa* N	*Iowa* Mean	*New York City* N	*New York City* Mean
			Males			
3	351	61.4	749	61.7	1443	59.8
6	406	67.6	792	67.5	1261	65.9
9	395	71.4	738	71.3	930	70.1
12	401	74.5	772	74.3	797	72.5
15	265	77.4	607	77.1	593	75.8
18	297	80.9	614	79.9	548	78.2
24	260	85.8	643	85.4	480	83.4
			Females			
3	323	59.9	737	60.1	1266	58.7
6	376	65.8	718	65.8	1193	64.1
9	360	70.3	699	69.8	900	68.4
12	339	73.3	717	72.6	762	71.4
15	315	76.2	589	75.7	611	74.5
18	251	79.1	599	78.7	496	77.4
24	278	82.9	570	83.7	514	82.3

Woodbury considered the "excess stature" in California due to "selection of the tallest . . . in the process of migration, or favorable environmental conditions such as climate" (p. 53). The "deficiency in stature" for New York City he regarded as "probably to be accounted for by the large proportion of children of short-statured races, such as the Italian and the Jewish" (p. 53).

An advance report of the Woodbury findings on Iowa infants was supplied to Baldwin (1921) for inclusion in a concurrent publication. As published by Baldwin, the tables for Iowa infants carried one row of material not retained in Woodbury's publication. This row gave average stature "at birth" as 52.4 cm. for 29 males and 53.9 cm. for 24 females. Apparently these Iowa cases afforded almost half the data utilized by Woodbury in computing his birth averages for "White" infants.

Finally, the total records for White infants examined in California and New York City were sorted successively for "diseased or enlarged tonsils," "adenoids," "carious teeth," "heart abnormality," and "rachitis." Only for infants diagnosed as having rickets or a heart abnormality was a tendency to "deficiency in stature" indicated. (In this connection it should be recalled that Woodbury excluded records carrying the diagnoses "rachitis" and "heart abnormality" from all previous analyses.) Compared with central tendency values for the total series of White infants measured in California and New York City the "heart abnormality" subgroup was shorter by an average of 1.9 cm. in the first year (34 infants) and 0.9 cm. in the second year (39 infants). For the "rachitis" subgroup, corresponding average differences were 1.6 cm. in the first year (139 infants) and 2.7 cm. in the second (205 infants).

INDEX OF NAMES

INDEX OF NAMES

Adair, Fred L. 12, 29, 42, 70, 72, 74, **115**, 161, **226**, 230; also Appendix, Tables Ia, Ib, Ic.

Ayres, J. G. **159**, 229; also Appendix, Tables VIa, VIb, VIc, IXa, IXb, IXc.

Bakwin, Harry 4, 5, 12, 13, 14, 17, 19, 21, 22, 29, 30, 31, 32, 34, 35, 36, 37, 39, 42, 43, 48, 77, 78, 79, 80, 88, 90, 91, 93, 94, **115-121**, 133, 141, 142, 148, 172, 185, 222; also Appendix, Tables Ia, Ib, Ic, IIIa, through VIc.

Bakwin, Ruth Morris 4, 5, 12, 13, 14, 17, 19, 21, 22, 29, 30, 31, 32, 34, 35, 36, 37, 39, 42, 43, 48, 77, 78, 79, 80, 88, 90, 91, 93, 94, **115–121**, 133, 141, 142, 148, 172, 185, 222; also Appendix, Tables Ia, Ib, Ic, IIIa through VIc.

Baldwin, Bird T. 12, 13, 17, 24, 42, 43, **121–122**, 231, 236; also Appendix, Tables Ia, Ib, II through IVb, Va through VIb, VII, VIIIa, VIIIb, IXa, IXb.

Barnes, Donald J. 52, 83, 84, 90, 97, 100, 103, 104, **148–150**.

Bartelme, Phyllis F. 13, 43, 73, 74, **193–194**; also Appendix, Tables IVb, Va, Vb, VIIIa, VIIIb, IXa, IXb.

Bayer, Leona M. 76, 77, 91, **122**.

Bayley, Nancy 5, 6, 13, 24, 31, 42, 43, 44, 48, **49**, 62, **122–124**, 178, 185, 186, 198; also Appendix, Tables II through IXc.

Benedict, Francis G. 12, 13, 39, 42, 93, 94, **124–125**; also Appendix, Tables Ia through IIIb, IVa, IVb, Va, Vb, VIa, VIb, VIIIa, VIIIb, IXa, IXb.

Benjamin, H. R. 72, **156–157**.

Blackfan, Kenneth D. 70, 71, 73, **125–126**.

Blatt, Maurice L. 13, 43, 91, 93, 95, 107, 108, 109, **127–132**; also Appendix, Tables IIIa, IVa, VIa, VIIIa, IXa, IXb.

Borsook, D. 138.

Bovaird, David **132–133**, 142.

Bowditch, H. P. 43, **134**; also Appendix, Tables VIIIa, VIIIb, VIIIc.

Boyd, Edith 12, 13, 42, **134**, 196; also Appendix, Tables Ia, Ib, Ic, IVa, IVb, IVc, VIa, VIb, VIc, VIIIa through IXc.

Boyd, Julian D. 76, 77, 91, **135**, 174.

Boynton, Bernice 4, 24, **135–136**, 198; also Appendix, Tables IIIa through IXc.

Brennemann, Joseph 180.

Brines, John K. **136**.

Brown, Addison W. 12, 17, 20, 29, 39, 40, 41, 42, **190–191**, 192; also Appendix, Tables Ia, Ib, Ic.

Browne, Florence A. 52, 83, 84, 90, 97, 100, 103, 104, **148–150**.

Bruch, Hilde 88, 91, **137**.

Capper, Aaron 74, **137–138**.
Cates, H. A. 5, **138**; also Appendix, Tables Ia, Ib, Ic.
Catherwood, Ruth 75, 76, 90, 91, **217–218**.
Chaille, Stanford E. 13, **138–139**; also Appendix, Tables Ia, IVa, VIa.
Chapin, Henry Dwight 5, 12, 13, **139**; also Appendix, Tables Ia, IIIa, IVa, Va, VIa, VIIIa.
Chesire, Leone E. 4, 43, 229, **231**; also Appendix, Tables IXa, IXb, IXc.
Christie, Amos U. 18, 38, 47, 75, **139–140**.
Clagett, Dorothy D. **140–141**.
Colby, Martha G. **200–202**.
Cook, Paul 70, 73, **141–142**.
Cooley, Thomas B. 17, 18, 19, 94, 97, 98, 99, 102, 103, 104, 105, 106, 107, **200–203**, 204, **215–216**; also Appendix, Tables IIIa, IVa, Va, VIa, VIb, VIc.
Coppoletta, Joseph M. 133, **142**; also Appendix, Tables II, IIIa, IVa, Va, VIa, VIIIa and IXa.
Crum, Frederick S. 13, 15, 17, 42, **142–143**, 167; also Appendix, Tables IVa, IVb, Va, Vb, VIa, VIb, VII, VIIIa, VIIIb, IXa, IXb.

Dafoe, Allan Roy 71, **143–144**.
Dafoe, William A. 71, **143–144**.
Dalrymple, Alice J. **126–127**.
Daniels, Amy L. **144–145**; also Appendix, Tables IIIb, IVb.
Davenport, Charles B. 5, 13, 55, 56, 58, 59, 63, 65, 67, 79, 81, 82, 83, 84, 90, **145–147**; also Appendix, Tables II, VIa, VIc.
Davis, Frank C. 5, 6, 13, 24, 31, 42, 43, 44, 48, 49, 62, 122, **123–124**, 178, 185, 186, 198; also Appendix, Tables II through IXc.
Davis, Joseph H. 76, 77, 91, **122**.
Deamer, W. G. 72, **156–157**.
Dippel, A. Louis 18, 38, 47, 75, **139–140**.
Drager, W. 58, 59, 65, 67, **146–147**.
Dunham, Ethel C. 18, 38, 47, 75, **139–140**.

Elias, Herbert L. 13, 93, 95, 105, 106, **147–148**; also Appendix, Tables IIIa, IVa, Va, VIa.
Eliot, Martha M. 52, 83, 84, 90, 97, 100, 103, 104, **148–150**.

Faber, H. K. 54, 58, 59, 66, **159–160**.
Festinger, Leon v.
Fillmore, Eva A. 13, 17, 24, 42, 43, **122**; also Appendix, Tables IIIa through IVb, Va through VIb, VII, VIIIa, VIIIb.
Fleischner, Emanuel C. 13, **150–151**; also Appendix, Tables Ia, IVa, VIa.
Francis, Carl C. 12, 79, 80, 90, 93, 94, 133, **151–152**; also Appendix, Tables IIIa, IIIb, IVa, IVb, Va, Vb, VIa, VIb.
Frederick, W. G. 13, **180**; also Appendix, Tables II, IIIa, IIIc, IVa, IVc, Va, Vc.
Freeman, Rowland G. 13, 121, **152–153**, 160, 219, 231; also Appendix, Tables IIIa, IVa, Va, VIa, IXa.

Freeman, Rowland G. Jr. 13, 17, 22, 42, 43, 51, 137, **153–154**, 172; also Appendix, Tables Ia through IXc.

Gebhart, John C. 13, 17, 43, **154–155**; also Appendix, Tables VIIIa, VIIIb, VIIIc.

Gesell, Arnold 13, 17, 30, 31, 42, 43, 48, **155–156**; also Appendix, Tables IIIa through VIc.

Gibson, John G. **136**.

Goddard, Henry M. 156; also Appendix, Tables IVb, VIIIa, VIIIb.

Goff, Eva A. **172–174**; also Appendix, Tables IIIb, IVb, Vb.

Goodman, Jack L. v, 5, 13, 29, 40, 41, 42, 46, 47, **191–192**; also Appendix, Tables Ia, Ib, Ic.

Goodwin, J. C. 5, **138**; also Appendix, Tables Ia, Ib, Ic.

Gordon, H. H. 72, **156–157**.

Gottschall, Gertrude 87, 90, **180–181**.

Grandprey, Medora B. **157–158**; also Appendix, Tables IIIc, IVc, Vc, VIc, VII, VIIIc, IXc.

Gray, Horace, 54, 56, 57, 58, 59, 63, 66, **158–160**, 229; also Appendix, Tables VIa, VIb, VIc, IXa, IXb, IXc.

Grover, Joseph I. 13, 42, **160**; also Appendix, Tables IIIa, IIIb, IVa, IVb, VIa, VIb, VIIIa, VIIIb, IXa, IXb.

Gunstad, Borghild 12, 29, 40, 41, 42, 43, **160–161**, 192; also Appendix, Tables Ia, Ib, Ic.

Haas, Sidney V. 75, 76, 90, 91, 108, 110, **161–163**.

Hadley, Lora 13, 17, 24, 42, 43, **122**; also Appendix, Tables IIIa through IVb, Va through VIb, VII, VIIIa, and VIIIb.

Hall, (Mrs.) Winfield S. 4, 55, 56, 63, 64, **163–164**.

Hamil, Brenton M. 13, 17, 18, 19, 85, 86, 93, 94, 97, 98, 99, 102, 103, 104, 105, 106, 107, **164–165**, **200–203**, 204, **215–216**; also Appendix, Tables II, IIIa, IVa, Va, VIa, VIb, VIc.

Harris, Ellis H. 13, 95, 108, 109, **127–130**; also Appendix, Tables IIIa, IVa.

Harris, J. Arthur 39, 40, **165–166**.

Hathaway, Milicent L. **140–141**.

Hatt, Elise 4, 43, 229, **231**; also Appendix, Tables IXa, IXb, IXc.

Hejinian, Lucea M. **144-145**; also Appendix, Tables IIIb, IVb.

Helms, Samuel T. 108, 109, **177–178**.

Hess, Alfred F. 13, 85, 86, 93, 95, **166–167**; also Appendix, Tables IVa, VIa, VIIIa.

Hess, Julius H. 193–194.

Higgons, Reginald A. 5, 13, 15, 24, 31, 35, 37, 42, 43, 44, 48, 97, 98, 101, 103, 104, **197–198**; also Appendix, Tables II through IXc.

Hollingworth, Leta Stetter 12, 17, 21, 42, 172, **194–195**, 228; also Appendix, Tables Ia, Ib, Ic.

Holt, Luther Emmett 12, 13, 15, 42, 156, 160, **167–168**, 170, 172, 183, 232, 233; also Appendix, Tables Ia, Ib, IVa, IVb, VIa, VIb, VIIIa, VIIIb, IXa, IXb.

Hoobler, B. Raymond 96, 108, **168–169**.

Howland, John **167–168**; also Appendix, Tables IVa, IVb, VIa, VIb, VIIIa, VIIIb, IXa, IXb.
Hrdlicka, Ales 20, **169–171**, 232, 233; also Appendix, Table IXa.

Irwin, D. 138.
Ito, Paul K. 19, 20, **171–172**; also Appendix, Tables Ia, Ib, Ic.

Jacobs, Howard M. 13, 95, 108, 109, **127–131**; also Appendix, Tables IIIa, IVa.
Jeans, Philip C. 13, **42**, 75, 76, 81, 82, 90, 91, 93, 94, 97, 98, 101, 103, 104, **172–175**, **217–220**; also Appendix, Tables II, IIIa, IIIb, IVa, IVb, Vb.
Jenss, Rachel M. 18, 38, 47, 52, 75, 83, 84, 90, 97, 100, 103, 104, **139–140**, **148–150**.
John, Henry J. 76, 77, 91, **176**.
Johnson, Buford J. 13, 43, **176**; also Appendix, Tables IXa, IXb, IXc.
Jones, Allene, 117.
Joslin, C. Loring 108, 109, **177–178**.

Kennedy, Ruth 17, 18, 19, 35, 36, 37, 42, 95, 97, 99, 101, 103, 104, 105, 106, **205–207**; also Appendix, Tables IIIb, IVb, Vb, VIb, VIIIb, IXb.
King, Irving 54, 55, 56, 57, 63, **178**.
Knott, Virginia B. v.
Kohn, Jerome L. 74, **212–213**.
Kunkel, Paul **136**.

Lane, Dorothy E. **178–180**.
Law, John L. 13, **180**; also Appendix, Tables II, IIIa, IIIc, IVa, IVc, Va, Vc.
Lennarson, Vernon E. 70, 72, 74, **226**, 230.
Levine, Samuel Z. 72, 87, 90, **156–157**, **180–181**.

MacArthur, John W. 143.
Macy, Icie G. 13, 17, 18, 19, 85, 86, 94, 97, 98, 99, 102, 103, 104, 105, 106, 107, **164–165**, **200–203**, 204, **215–216**; also Appendix, Tables II, IIIa, IVa, Va, VIa VIb, VIc.
Macy, Mary Sutton 13, **181**; also Appendix, Tables Ia, IVa, VIa, VIIIa, IXa.
Maresh, Marion M. 4, 13, 17, 26, 31, 42, 43, 44, 52, 53, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 137, **181–183**, 186; also Appendix, Tables II through IXc.
Marples, E. 72, **156–157**.
Martmer, Edgar 168.
McKinley, John B. 75, 76, 90, 91, **172–174**, **217–218**; also Appendix, Tables IIIb, IVb, Vb.
McLeish, (Mrs.) Andrew 57, 59, 65, **183–184**.
McNamara, H. 72, **156–157**.
Meredith, E. Matilda v.

Meredith, Howard V. 5, 6, 12, 13, 17, 20, 24, 29, 30, 31, 32, 33, 34, 35, 38, 39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 51, 52, 53, 54, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 79, 80, 81, 82, 90, 92, 93, 130, 135, 158, **184–192**, 198, 232; also Appendix, Tables Ia, Ib, Ic, IIIa through IXc.

Meyer, Arthur William 12, 17, **192–193**; also Appendix, Tables Ia, Ib, Ic.

Michelson, Nicholas **19**.

Milgram, Lillian 4, 13, 30, 31, 32, 34, 35, 36, 37, 42, 43, 48, 78, 79, 88, 119, **120–121**, 141, 148, 185, 222; also Appendix, Tables Ia, IIIa, through VIc.

Mohr, George J. 13, 43, 73, 74, **193–194**; also Appendix, Tables IVb, Va, Vb, VIIIa, VIIIb, IXa, IXb.

Montague, Helen 12, 17, 21, 42, 172, **194–195**, 228; also Appendix, Tables Ia, Ib, Ic.

Moriarty, Margaret E. **226–227**.

Murphy, John B. 108, 109, **130–131**.

Nelson, E. M. 52, 83, 84, 90, 97, 100, 103, 104, **148–150**.

Nelson, Martha Van Kirk 42, 76, 77, 91, 93, 94, **135**, **195–196**, 219; also Appendix, Tables IIIb, IVb, Vb.

Nicoll, Matthias, **132–133**, 142.

Oelke, Martha J. **172–173**.

Palmer, Carroll E. 4, **196**.

Peatman, John Gray 5, 13, 15, 24, 31, 35, 37, 42, 43, 44, 48, 97, 98, 101, 103, 104, **197–198**; also Appendix, Tables II through IXc.

Peckham, C. H. 18, 75, **198–200**, 230.

Peckham, George W. 13, 15, 43, 139, **200**; also Appendix, Tables VIIIa, VIIIb.

Platt, Virginia 17, 22, 42, 51, **154**, 172; also Appendix, Tables Ia through II.

Poole, Marsh W. 13, 17, 18, 19, 85, 86, 94, 97, 98, 99, 102, 103, 104, 105, 106, 107, **164–165**, **200–203**, 204, **215–216**; also Appendix, Tables II, IIIa, IVa, Va, VIa, VIb, VIc.

Raiford, T. E. 35, 36, 37, 93, 94, **204**; also Appendix, Tables II, IIIa, IIIb, IVa, IVb, Va, Vb, VIa, VIb.

Rapoport, Milton 17, 18, 19, 35, 36, 37, 42, 95, 96, 97, 98, 99, 100, 101, 103, 104, 105, 106, **204–207**; also Appendix, Tables IIIb, IVb, Vb, VIb, VIIIb, IXb.

Reynolds, Lawrence 13, 85, 86, 94, **164–165**; also Appendix, Tables II, IIIa, IVa, Va, VIa.

Rhoads, Teresa Folin 17, 18, 19, 35, 36, 37, 42, 93, 95, 98, 99, 101, 103, 104, 105, 106, 107, **205–207**; also Appendix, Tables IIIb, IVb, Vb, VIb, VIIIb, IXb.

Richdorf, Lawrence F. 13, 17, 42, 196, **207–208**; also Appendix, Tables Ia through Vc.

Riggs, Theodore F. 12, 17, 172, **208–209**; also Appendix, Tables Ia, Ib.

Robinson, Edith C. 83, 84, 96, 97, 99, 103, 104, **209–211**.
Rude, Anna E. 5, 13, 31, 32, 42, 43, **211**; also Appendix, Tables II, IIIa, IIIb, IVa, IVb, Va, Vb, VIa, VIb, VII, VIIIa, VIIIb, IXa, IXb.

Sawtell, Ruth Otis 43, 44, **211–212**, 231; also Appendix, Tables VIa, VIb, VIc, IXa, IXb, IXc (See also Wallis, Ruth Sawtell).
Scammon, Richard E. v, 12, 29, 42, **115**; also Appendix, Tables Ia, Ib, Ic.
Schapiro, I. E. 13, 93, 95, 107, 108, **131–132**; also Appendix, Tables IVa , VIa, VIIIa, IXa.
Schwarz, Herman 74, **212–213**.
Sears, Robert R. iii, v.
Sherwin, Carl P. 81, 90, 91, 92, **233**.
Shinn, Milicent Washburn 4, 5, 54, 57, 59, 65, 147, **213**, 183.
Simmons, Katherine 5, 12, 13, 17, 24, 29, 30, 31, 32, 34, 42, 43, 44, 48, 52, 53, 61, 62, 68, 186, **213–215**; also Appendix, Tables Ia, Ib, Ic, IIIa through VIc, VIIIa through IXc.
Sisson, Warren R. **226–227**.
Slyker, Francis 93, 94, 97, 98, 99, 102, 103, 104, 204, **215–216**; also Appendix, Tables II, IIIa, IVa, Va, VIa.
Sontag, Lester Warren **216–217**.
Stearns, Genevieve 13, 42, 75, 76, 81, 82, 90, 91, 93, 94, 97, 98, 101, 103, 104, **172–175**, **217–220**; also Appendix, Tables II, IIIa, IIIb, IVa, IVb, Vb.
Stebbins, Theodora H. 13, 29, 42, **220**; also Appendix, Tables Ia, Ib, Ic.
Stinger, Dorothy **173–174**; also Appendix, Tables IIIb, IVb, Vb.
Stockton-Hough, John 12, 14, 39, 42, 172, **220–221**; also Appendix, Tables Ia, Ib.
Stokes, Joseph Jr. 17, 18, 19, 35, 36, 37, 42, 95, 96, 97, 98, 99, 100, 101, 103, 104, 105, 106, **204–207**; also Appendix, Tables IIIb, IVb, Vb, VIb, VIIIb, IXb.
Stuart, Harold C. 5, 6, 13, 15, 17, 31, 32, 37, 42, 43, 44, 48, 49, 54, 56, 57, 58, 59, 60, 63, 66, 67, 92, 137, 144, **221–225**, 185; also Appendix, Tables Ia, Ib, Ic, IIIa through VIc, VIIIa through IXc.
Stutsman, Rachel 4, 43, 229, **231**; also Appendix, Tables IXa, IXb, IXc.
Swanson, Roy Edwin 5, 42, 43, **226**; also Appendix, Tables Ib, VIb, IXb.
Swanson, William W. 70, 72, 74, **226**, 230.
Sweeney, Mary E. 4, 43, 229, **231**; also Appendix, Tables IXa, IXb, IXc.

Talbot, Fritz B. 12, 13, 39, 42, 93, 94, **124–125**, **226–227**; also Appendix, Tables Ia through IIIb, IVa, IVb, Va, Vb, VIa, VIb, VIIIa, VIIIb, IXa, IXb.
Taylor, Rood 12, 17, 21, 42, **227–228**; also Appendix, Tables Ia, Ib, Ic.
Thompson, Helen 13, 17, 30, 31, 42, 43, 48, **155–156**; also Appendix, Tables IIIa through VIc.
Tiber, Leon J. 13, 42, **228**; also Appendix, Tables Ia, Ib, Ic.
Todd, T. Wingate 5, 12, 13, 17, 24, 29, 30, 31, 32, 34, 42, 43, 44, 48, 52, 53, 61, 62, 68, 186, **213–215**; also Appendix, Tables Ia, Ib, Ic, IIIa through VIc, VIIIa through IXc.

TRELOAR, ALAN E. 12, 29, 40, 41, 42, 43, **160–161**, 192; also Appendix, Tables Ia, Ib, Ic.
TURNER, REUBEN 13, 93, 95, 105, 106, **147–148**; also Appendix, Tables IIIa, IVa, Va, VIa.

VANDECAR VERA, 42, 81, 82, 90, 97, 98, 101, 103, 104, 175, **218–220**; also Appendix, Tables IIIb, IVb, Vb.

WALKER, J. R. 232.
WALLIS, RUTH SAWTELL 5, 6, 13, 42, 43, 137, 154, 194, **229**; also Appendix, Tables VIa, VIb, VIc, IXa, IXb, IXc. (See also Sawtell, Ruth Otis).
WASHBURN, ALFRED H. 4, 13, 17, 26, 31, 42, 43, 44, 52, 53, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 137, **181–183**, 186; also Appendix, Tables II through IXc.
WHITE, PRISCILLA 76, 77, 91, **229–230**.
WILCOX, DANIEL A. 72, **230**.
WILSON, CHARLES A. 4, 43, 229, **231**; also Appendix, Tables IXa, IXb, IXc.
WILSON, JAMES R. 87, 90, **180–181**.
WISE, FAIRYE C. 32, 33, 34, 43, **231–232**; also Appendix, Tables IXb, IXc.
WISSLER, CLARK 20, **232–233**; also Appendix, Tables IXa, IXb.
WOLBACH, S. B. 133, **142**; also Appendix, Tables II, IIIa, IVa, Va, VIa, VIIIa, IXa.
WOLF, MAX 81, 90, 91, 92, **233**.
WOODBURY, ROBERT MORSE 4, 12, 13, 15, 17, 24, 42, 43, 83, 87, 90, 91, 137, 142, 143, 155, 157, 171, 173, 181, 185, 194, 198, 203, 211, **233–237**; also Appendix, Tables Ia, Ib, II through IXc.

YAGLOU, CONSTANTIN P. 70, 71, 73, **125–126**.

ZELDES, MARY 13, 95, 108, 109, **127–131**; also Appendix, Tables IIIa, IVa.

SUBJECT INDEX

SUBJECT INDEX

AGE DIFFERENCES:
    In size—*central tendency* 10–11, **14**, 17, 19, 21, 24–25, 30, 35, **43–44**, 71, 73, 74, 77–80, 84, 87, 90–91, 93, 97, 106–108, 116, 118, 120–125, 128, 132–134, 136, 138, 139, 142–145, 148, 151–154, 156, 159, 160, 164, 167–169, 171, 173, 174, 180–182, 184, 185, 193, 194, 196, 198, 201, 203, 204, 206–208, 211, 212, 214, 216, 219, 220, 222, 226–229, 234–236; *variability* **45–46**, **48**, 118, 120, 122–124, 133, 134. 136, 145, 153, 154, 156, 159, 171, 180, 182, 184, 185, 198, 206, 208, 212, 214, 220, 222, 227–229, 234; *correlation* **61–62**, 124, 182, 186, 214–215; *records for individuals* **55–60**, 76, 77, 80–83, 92, 123, 135–137, 141, 145–147. 158, 160, 162, 163, 170, 176, 178, 181–183, 187, 212, 225, 227, 232.
    In gain—*central tendency* 33, **50**, 51, **53–54**, 68, 80, 93, 100, 102, 103, 110, 126, 131, 136, 145, 163, 174, 184; *variability* 51, **53**, 104, 184; *correlation* **68–69**, 215; *records for individuals* **63–67**, 76, 80, 81, 83, 84, 92, 123, 135, 145. 158, 160, 178, 181, 186.
AMERICAN INDIAN INFANTS (See under Race)
ANALYSIS OF DATA (See Statistical treatment and Growth of the individual)
ANCESTRY (See Race, Ethnic groups, and Familial data)
ANTHROPOMETRIC TECHNIQUE:
    Orientation of subjects **4–5**, 26, 31, 115, 123, 134, 136, 138, 139, 151, 154, 155, 160, 163–164, 171, 183, 184, 196, 197, 211, 213, 214, 220, 221, 226, 229, 231.
    Instruments and procedures **5**, 117, 136, 139, 154–155, 180, 229, 234.
    Reliability of data **5**, 33, 45, 46, 49, 51, 122, 138, 145, 171, 187, 192, 211, 213, 221–222, 229.

BIRTH ORDER **38–39**, 40, 75, 117, 124–125, 139–140, 155, 165–166, 171, 190–191, 199–200, 208–209, 221, 223–224, 227.

CADAVERA (See Mortality)
CENTRAL TENDENCY VALUES (See under Statistical treatment)
CONSTANCY OF STATURE RANK **54–62**, **68–69**, 123, 124, 144, 145, 146, 147, 158, 160, 178, 182, 183, 186, 214–215, 225.

DENSITY OF POPULATION **24–27**, 31, 122.
DIET:
    Dietary components—*milk studies* **91–96**, 110–111, 127–128, 144–145, 151–152, 172–173, 195–196, 204–205, 215–216, 233; *vitamin D studies* 84, 85, 91, **97–105**, 111, 148–150, 174–175, 206–207, 209–211, 218–220; *mineral and vitamin B studies* 91, **105–110**, 111, 128–132, 147–

Diet—Continued.
148, 168–169, 177–178, 200–203, 206; *miscellaneous* 85–86, 161–163, 164–165, 166–167, 172–173, 179–180, 205–207.
  Degree of experimental control—*rigorously controlled dietary* 76–77, 81, 94, 95, 97, 101, 102, 109, 127–132, 135, 144–145, 172–175, 195–196, 204–205, 218–220; *prescribed and supervised dietary* 19, 36, 52, 85, 86, 94, 97, 102, 105, 143–144, 148–150, 164, 168–169, 179–180, 193–194, 201–204, 205–207, 209–211, 215–216; *prescribed dietary* 18–19, 27, 31, 36, 37, 76, 94, 95, 97, 102, 105, 106, 107, 115, 118, 120, 147, 166–167, 177–178, 197–198, 207–208, 213–215, 221–225; *description of dietary history* 4, 33, 67–68, 92–96, 99, 100, 105, 109, 115–116, 125, 126, 129–131, 143, 145, 147, 148, 152, 162, 166, 168, 169, 177, 187–188, 197, 223–225, 232.
  See also Malnutrition.
Dionne quintuplets (See Familial data)
Disease conditions (See Morbidity)

Emotional factors 217.
Eskimo infants (See under Race)
Ethnic groups:
  White infants of northwest European descent 15, **16–17**, **20–22**, 30, 33, 51, 70, 81, 82, 83, 84, 116, 118, 123, 136, 141, 145, 146, 155, 159, 163, 165, 178, 182, 184–192, 197, 200, 205, 207, 211, 213, 214, 219, 221, 223, 226, 227, 228, 234, 235.
  White infants of southeast and central European ancestry **16–17**, **20–23**, 32, 99, 101, 116, 118, 141, 145, 154, 165, 197, 205, 211, 227, 234–236.
  For Negroid, Mongoloid, American Indian and Eskimo materials see under Race.

Familial data 3, 55–56, 58, 63, 66, 71–72, 134, 140–141, 143, 178, 179, 222–225.
Feebleminded infants (See Intelligence)

Geographic location:
  General and comparative **24–27**, 234–236.
  Eastern states (East coast to 85° W. Longitude) 14–15, 18–19, 24–26, 30, 36, 52, 60, 70, 72, 73, 75, 77, 78, 79, 84, 87, 95, 96, 108, 115–121, 124–125, 132, 134, 136–138, 140, 142, 145–150, 151, 153–155, 157, 159, 160, 164, 165, 167, 168, 176, 177, 181, 192, 194, 197, 199, 201, 202, 204, 206, 212, 213, 216, 220, 221, 223, 227, 229, 230, 231, 234, 236.
  Middle states (85° to 109° W. Longitude) 20, 24–26, 30, 32, 70, 72, 73, 74, 84, 115, 122, 127–132, 134, 135, 171–175, 182, 184–193, 207–209, 211, 218, 220, 226, 227, 231, 232, 234, 236.
  Western states (West of 109° W. Longitude) 19, 20, 24–26, 70, 84, 87, 122–124, 141, 169, 171, 213, 234, 236.
Growth of the individual 3, **54–69**, 75–76, 77, 79–80, 80–83, 84, 85–86, 91–93, 104, 122, 123, 135, 144–147, 158, 160, 162, 163, 166, 178, 179, 182, 183, 187, 213, 217–220, 222–225, 227, 233.

GROWTH RATES (See Increments and Rate of growth)

HEALTH CARE (See Pediatric care and Diet)

ILLNESS (See Morbidity)

INCREMENTS:
- Absolute 11, 15, 33, 34, 41, **49–54**, 68, 70–71, 72, 76, 80, 81, 83, 84, 85, 92, 93, 96, 100, 102, 103, 108, 109, 110, 126, 129, 130, 131, 135 136, 144, 145, 149, 154, 156, 158, 160, 166, 167, 169, 174–175, 177, 178, 184, 186, 205–208, 210, 213, 214–216, 218–220, 226, 233.
- Percentage 11, **49–51**, **62–67**, 69, 136, 154, 156, 158, 160, 178, 184, 206–208, 213, 226.

INDIVIDUAL DIFFERENCES **51–54**, 70, 73, 74, 87, 88, 115, 123, 124, 126, 130, 133, 134–139, 141, 142, 144, 145, 153, 154, 156, 157, 172, 176, 180, 181, 182, 184–186, 190, 192, 193, 195, 203, 219, 220, 225, 227, 229–232, 234–235. See also Growth of the individual.

INDIVIDUAL GROWTH (See Growth of the individual)

INFANTS OF JAPANESE ANCESTRY (See under Race)

INTELLIGENCE 156

MALNUTRITION 116, 139, 150–151, 152, 155.

MATERNAL RELATIONSHIPS:
- Age of mother 38, **40**, 165, 190–191.
- Stature of mother 38, **40–41**, 161, 190–191, 192.
- Parity of mother (See Birth order)

MEAN STATURE (See under Statistical treatment)

MEASUREMENT TECHNIQUE (See Anthropometric technique)

MEASURES OF VARIABILITY (See under Statistical treatment)

MENTAL AND EMOTIONAL FACTORS (See Intelligence and Emotional factors)

MONGOLOID INFANTS (See under Race)

MORBIDITY:
- Illness history, 65, 67–68, 80–83 119, 130, 133, 143–144, 146, 147, 152, 159, 163, 172, 175, 178. 180, 188–190, 195, 203, 206, 210. 219–220, 223–224, 233.
- Specific disease conditions—*Celiac disease* **75–76**, 90, 91, 161–162, 217–218; *Diabetes mellitus* **76–77**, 91, 122, 135, 176, 229–230; *Eczema* **77–79**, 90, 116–117, 119, 152; *Gastrointestinal disorders* **79–81**, 90, 116–117, 133, 152; *Heart abnormality* **87**, 237; *Infected tonsils, adenoids* **87**, 91, 237; *Marasmus* **87–88**, 90, 133, 180–181 (See also Malnutrition); *Obesity* **88**, 91, 137; *Respiratory disorders* 78, **81–83**, 89, 90, 133, 175, 219–220; *Rickets* **83–85**, 90, 91, 139, 146, 149–150, 204–205, 209–211, 237; *Scurvy* **85–87**, 90, 164–165, 166–167; *Tetany* **88–89**, 90, 116–117; *Tuberculosis* **89**, 90, 91, 127; *Miscellaneous* 75, 89–91, 133, 175, 237.

MORTALITY 70, 79, 116, 132–133, 142, 151–152.

MULTIPLE BIRTHS 71–72, 75, 140–141, 143, 179, 193, 199–200, 212.

NEGRO INFANTS (See under Race)

Neonate 27–29, 69–70, 72, 74–75, 115, 117–118, 124–126, 134, 138–142, 144, 147, 154, 161, 165, 171–172, 178, 181, 187, 190–192, 194–195, 208, 209, 213, 214, 217, 220, 222, 226–228, 230, 235, 237.
Nutrition (See Diet and Malnutrition)

Order of birth (See Birth order)

Parity (See Birth order)
Pathological data (See Morbidity and Mortality)
Pediatric care 15, 19, 27, 30, 31, 34–38, 70, 73, 74, 75–82, 115–119, 120–121, 125–133, 135, 143–144, 152, 153, 161–163, 167–169, 172–175, 177, 178, 193–194, 197–198, 207, 210, 213–215, 218–220, 221, 224.
Percentage gains (See under Increments)
Percentiles 9–11, **46–47**, **53**, 60, 61, 123, 157–158, 185, 186, 190, 192, 195, 208, 220, 222, 225, 228, 231, 234.
Prediction (See Constancy of stature rank and Maternal relationships)
Pregnancy order (See Birth order)
Prematurity **69–75**, 125–126, 137–138, 140–144, 151, 157, 193–194, 199–200, 212–213, 226, 227, 230.

Race:
- Negroid **16–19**, **22–24**, 35, 51, 52, 72, 75, 84, 85, 94, 95, 99, 100, 102, 103, 105, 106, 132, 139–140, 149–151, 153, 154, 157, 192, 193, 195, 199, 201–203, 205–209, 211, 230, 233, 235.
- White 11–12, **14–15**, **16–20**, 23, 30, 35, **41–69**, 72, 73, 75, 84, 85, 87, 94, 95, 99, 100–103, 105, 106, 115–119, 123, 124, 139–140, 147, 149–151, 153, 154, 157, 159, 165, 183, 192–193, 195, 199, 201–209, 211, 217, 220, 228–231, 233.
- Other—*Mongoloid* 16, **19–20**, **23**, 171–172, 195; *American Indian* 16, **20**, 169–170, 232–233; *Eskimo* 16, **20**, 170; for White subgroups see under Ethnic groups.

Rate of growth (growth tempo) 22, 34, 49–54, 54–55, 56–57, 59–60, 62–69, 81–82, 86–87, 96, 103–104, 110, 121, 131, 145, 146–147, 165–167, 173–175, 184, 196, 198, 201–202, 210, 213, 218–219, 235. See also under Increments and Growth of the individual.
Recumbent stature (See Anthropometric technique, Orientation of subjects)
Regional differences (See Geographic location and Density of population)
Reliability (See under Anthropometric technique and Statistical treatment)
Rural-urban differences (See Density of population)

Seasonal differences 117–118.
Secular differences **11–15**, 17, 32, 139, 168.
Seriatim records (See Growth of the individual)
Sex differences 6, **39–54**, 59, 68, 115, 117–122, 124–127, 134, 136–138, 141, 143, 146, 149, 150, 152, 153–156, 158–161, 165–168, 170–172, 176, 182, 185–186, 190–194, 196, 198, 200, 204, 208, 211, 212, 214–215, 220, 221, 222, 227–229, 232, 234–236.
Siblings (See Familial data)

SOCIO-ECONOMIC STATUS:
  General and comparative **27–38**, 44, 48, 51, 54, 117, 161, 171–172, 176, 182–183, 195, 231.
  Upper classes (Professional and managerial groups, private patients) 27–38, 43–44, 48–49, 50, 51, 54, 55–56, 58, 60, 65, 67, 80, 83, 92–94, 97, 102, 104, 107, 115, 121, 130, 134, 136, 151, 153, 159, 161, 163, 167, 178, 182, 184, 186, 187, 197, 207, 212, 214, 220, 221, 229, 231.
  Middle classes (Commercial and skilled groups, moderate-income families) 28–32, 35–37, 43–44, 48–49, 50, 54, 56, 58, 94, 97, 102, 104, 107, 116, 117, 118, 120, 134, 153, 155, 182, 184, 186, 207, 211, 214, 221, 226.
  Lower classes (Semiskilled, laboring groups, congested districts) 19, 20, 27–38, 44, 51, 52, 54, 56, 58, 65, 67, 79, 81, 82, 83, 86, 88, 92–95, 97, 101, 102, 104–106; 107, 116, 117, 119, 120, 127, 130, 147, 154, 161, 164, 182, 187, 190, 193, 195, 199, 201, 202, 204, 205, 215, 221, 231.
STATISTICAL TREATMENT:
  Analysis of seriatim data (See Growth of the individual)
  Analysis of non-seriatim data—*selection and/or rejection of data* 10, 11–12, 17–19, 24, 31, 45, 99, 115, 120, 128, 131–133, 138–140, 142, 143, 147, 149, 155, 161, 184, 190–194, 199, 201, 207, 208, 216, 221, 227, 228, 234; *age grouping* **6**, 45, 49, 100, 116, 118, 120, 122, 123, 125, 126, 131, 133, 136, 138, 148, 151, 158, 160, 163, 171, 172, 180, 184, 185, 198, 203, 204, 208, 211, 212, 214, 222, 227, 229, 232, 234; *experimental and control groups* 115–117, 119–121, 127–130, 132, 135, 147–149, 162–163, 168–169, 177–178, 201, 203, 206, 209, 216, 218, 237; *central tendency* 3, **6**, 9–12, 14, 17, 19–20, 24–25, 29, 30, 33, 34, 35, 40, 41, 43, 44, 50, 52–54, 64, 67, 68, 70, 71, 73, 74, 77–80, 84, 90–91, 93, 96, 97, 100, 102, 103, 106–110, 115–118, 120–134, 136, 138, 139, 142–145, 148, 149, 151–157, 159–161, 163, 164, 167–177, 180–182, 184–186, 190, 192–196, 198, 200, 201, 203–212, 214, 216, 218, 219–222, 226–232, 234–236; *variability* 3, 6 9–11, 14, 19, 21, 39, 41, **44–49**, 51, 53, 64, 66, 73, 74, 77, 115, 117–120, 122–124, 126, 130, 133, 134, 136, 138, 145, 153, 154–156, 159, 161, 171, 172, 176, 180, 182, 184–186, 190, 192, 195, 198, 203, 206, 208, 212, 214, 220, 222, 227–229, 231, 232, 234; *correlation and regression* 3, **39–41**, **60–62**, **68–69**, 124, 134, 146–147, 149, 161, 165, 180, 182, 186, 191, 192, 196, 204, 212, 214–215; *reliability of statistics* 14, 19, 21, 22, 26, 29, 32–33, 39, 40, 62, 69, 80, 87, 107, 117–119, 129, 149, 152, 161, 165, 203, 204, 207.
STATURE OF INDIVIDUALS (See Growth of the individual)
STATURE RECUMBENT (See Anthropometric technique, Orientation of subjects)

TECHNIQUE OF MEASUREMENT (See Anthropometric technique)
TEMPO OF GROWTH (See Rate of growth)
TWINS (See Familial data)

VARIABILITY (See under Statistical treatment)

APPENDIX

Twenty-three Tables Displaying Central Tendency and Variability Values for Stature at Nine Infancy Ages

TABLE Ia

STATURE OF NEONATES (Centimeters): Central tendency (mean or median) values from forty analyses of data for vertex-heel length taken in dorsal recumbency on infants of both sexes. Each value is supplemented with an itemization of major characteristics of the sample.

Investigator	Average	Cases	State	Period	Ancestry	Other Characteristics of Sample
Postnatal ages "immediately after birth" to 6 days						
Riggs (1904)	48.4	721	Maryland	c.1896–1904	Negro	"Full-term," single birth, over 40 cm., measured "within an hour."
Meyer (1915)	48.5	1027	Maryland	Before 1910	Negro	From lower classes, prenatal period 34 to 47 weeks, measured "at birth."
Stockton-Hough (1885)	48.8	712	Pennsylvania	1865–1872	White	"Newborn" infants.
Freeman and Platt (1932)	49.2	312	New York	. . .	White and Negro	Subjects "normal," 70% White, age "1 day."
Bakwin and Bakwin (1934)	49.5	194	New York	c.1929–1934	Mediterranean	Subjects "new-born," all measured by one anthropometrist.
Chaille (1887)	49.5	. . .	Possibly Louisiana	Before 1887	Probably White	"Ordinary . . . healthy" new-borns.
Bakwin and Bakwin (1934)	49.7	103	New York	c.1929–1934	Central European	"New-born" infants, all measured by one anthropometrist.
Chapin (1894)	49.7	9	New York	c.1894	Probably White	"Malnourished . . . below par," measured between birth and 6 days.
Riggs (1904)	49.7	779	Maryland	Before 1904	White	"Full-term," single birth, over 40 cm., measured "within an hour."
Stebbins (1933)	49.7	100	Iowa	1933	Mostly North European	Mainly from lower classes, over 2500 gm., measured "24 to 48 hrs."

Bakwin and Bakwin (1934)	49.8	73	New York	c.1929–1934	Jewish	Subjects "new-born," all measured by one anthropometrist.
Meyer (1915)	49.8	1031	Maryland	Before 1910	White	Prenatal period 34 to 47 weeks, measured "at birth."
Ito (1936)	49.8	202	California	1932–1935	Japanese	Mainly lower classes, 56% first-born, measured between birth and 7 days.
Simmons and Todd (1938)	49.9	117	Ohio	1931–1937	North European	80% from upper classes, "healthy," measured "at birth."
Bakwin and Bakwin (1934)	50.0	234	New York	c.1929–1934	North European	"New-born" infants, all measured by one anthropometrist
Montague and Hollingworth (1914)	50.2	2000	New York	c.1910–1914	Mainly South European	Middle and lower classes, "full-term," single birth, measured "immediately."
Stuart (1934)	50.2	113	Massachusetts	1930–1934	North European	Mainly middle classes, 50% Irish descent, over 2250 gm., measured under 48 hours.
Adair and Scammon (1921)	50.3	100	Minnesota	. . .	Probably White	Upper classes, over 2000 gm., 64% first-born, measured "within 48 hours."
Tiber (1930)	50.3	208	Minnesota	1928–1929	Mainly North European	"Mature, healthy," measured "within 6 hours."
Bakwin and Bakwin (1934)	50.3	1653	New York	c.1929–1934	White	"New-born" infants, all measured by one anthropometrist.
Gunstad and Treloar (1936)	50.4	862	Minnesota	1927–1930	. . .	"City public hospital" cases, viable single births, pre- and post-term.
Meredith and Goodman (1941)	50.4	100	Iowa	1941	Mostly North European	Mainly lower classes, over 2500 gm., measured "within 24 hours."

TABLE Ia—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Postnatal ages "immediately after birth" to 6 days						
Gunstad and Treloar (1936)	50.5	905	Minnesota	c.1927–1929	Probably White	"Private" cases, viable single births, no rejection for pre- or post-term.
Meredith and Brown (1937)	50.5	1040	Iowa	1930–1933	North European	Mainly lower classes, over 2500 gm., mothers normal, measured "first hour."
Benedict and Talbot (1915)	50.6	99	Massachusetts	1914–1915	White	"Full-term, non-pathological," measured "at birth."
Taylor (1919)	50.6	250	Minnesota	1914–1917	Mainly North European	"Charity" cases, "normal . . . at term," mostly first-born, age 4 to 6 days.
Boyd (1941)	50.6	25	Minnesota	. . .	Probably White	"Birth" measurements.
Holt (1897)	52.4	442	New York	Before 1897	Probably White	"Birth" measurements for "full-term" infants.
Macy (1912)	52.6	c.100	Probably New York	Before 1912	. . .	Sample considered representative for "Birth."
Baldwin (1921)	53.1	53	Iowa	1918–1919	Mostly North European	Records "at birth" obtained in Iowa during "Children's Year."
Woodbury (1921)	53.9	118	Iowa and Others	1918–1919	White	Records "at birth" obtained during "Children's Year."
Postnatal ages 7 to 14 days						
Freeman and Platt (1932)	49.8	149	New York	. . .	White and Negro	Subjects "normal," 70% White, age "8 days."
Stebbins (1933)	50.7	100	Iowa	1933	Mostly North European	Mainly from lower classes, over 2500 gm., measured "ninth day."

Tiber (1930)	51.0	208	Minnesota	1928–1929	Mainly North European	"Mature, healthy," measured at "end of first postnatal week."
Cates and Goodwin (1936)	51.4	672	Ontario	1933–1935	. . .	"Premature" and "over-term" rejected, measured 11th to 14th day.
Richdorf (1925)	51.4	47	Minnesota	. . .	Mainly North European	From middle and upper classes, "full-term," no defect or disease, age "1 week."
Bakwin, Bakwin and Milgram (1934)[1]	51.6	355	New York	c.1929–1934	"Caucasian"	From middle classes (income $30 to $35 weekly), about 2 weeks of age.
Bakwin, Bakwin and Milgram (1934)[2]	51.7	387	New York	c.1929–1934	"Caucasian," mainly Irish	From lower classes (income $15 to $22 weekly), about 2 weeks of age.
Stuart (1934)	51.7	83	Massachusetts	1930–1934	North European	Mainly middle classes, 50% Irish, over 2250 gm., measured 12th to 14th day.
Fleischner (1906)	52.8	c.75	New York	Before 1906	. . .	Hospital patients; some premature; rated 25% "well," 40% "poorly" nourished.

---

[1] See also Bakwin and Bakwin (1931, '36)

[2] See also Bakwin and Bakwin (1931)

TABLE Ib

STATURE OF NEONATES (Centimeters): Mean or median values representing the typical vertex-heel length for each of seventy samples of male and female infants and of infants of primiparae and multiparae.

Investigator	Males		Females		Major Characteristics of Sample
	Average	Number	Average	Number	
Postnatal ages "immediately after birth" to 6 days					
Freeman and Platt (1932)	49.1	47			Negro males, New York, "normal," age "1 day."
Stockton-Hough (1885)	49.4	330	48.3	382	White infants, see Table Ia.
Freeman and Platt (1932)	49.5	116			White males, New York, "normal," age "1 day."
Meyer (1915)	49.6	1033	48.7	1026	Negro and White infants, see Table Ia.
Freeman and Platt (1932)			49.0	149	White and Negro females, age "1 day," see Table Ia.
Ito (1936)	50.0	94	49.7	108	Japanese ancestry, around 4 days of age, see Table Ia.
Simmons and Todd (1938)	50.1	70	49.5	47	North European stocks, largely upper classes, see Table Ia.
Stebbins (1933)	50.2	50	49.2	50	White infants, measured on 2nd day, see Table Ia.
Bakwin and Bakwin (1934)	50.4	470			White males, "poverty-stricken" district of New York, "new-born."
Montague and Hollingworth (1914)	50.5	1000	49.9	1000	See Table Ia.
Adair and Scammon (1921)	50.5	55	50.0	45	See Table Ia.
Stuart (1934)	50.5	50	50.0	63	Measured 1st or 2nd day, see Table Ia.
Bakwin and Bakwin (1934)	50.6	818	50.0	835	See Table Ia. (Ancestry—White)
Meredith and Goodman (1941)	50.6	50	50.2	50	See Table Ia.
Tiber (1930)	50.8	106	49.8	102	Measured "within 6 hours," see Table Ia.
Meredith and Brown (1937)	50.8	534	50.2	506	See Table Ia.
Gunstad and Treloar (1936)	50.9	435	49.8	427	"Public hospital" cases, see Table Ia.
Gunstad and Treloar (1936)	50.9	447	50.1	458	"Private" cases, see Table Ia.

Benedict and Talbot (1915)	51.0	54	50.1	45	See Table Ia.
Taylor (1919)	51.2	125	50.0	125	Around 5 days of age, see Table Ia.
Bakwin and Bakwin (1934)	51.2	205			White males, "moderate-income" families of New York, "new-born."
Boyd (1941)	51.3	15	49.5	10	See Table Ia.
Baldwin (1921)	52.4	29	53.9	24	See Table Ia.
Holt (1897)	52.5	231	52.2	211	See Table Ia.
Woodbury (1921)	53.2	62	54.7	56	See Table Ia.
			Postnatal ages 7 to 14 days		
Freeman and Platt (1932)	49.8	75	49.8	74	White and Negro infants, age "8 days," see Table Ia.
Stebbins (1933)	51.3	50	50.2	50	Measured "ninth day," see Table Ia.
Richdorf (1925)	51.5	24	51.3	23	Measured around 1 week, see Table Ia.
Tiber (1930)	51.6	106	50.4	102	Measured at "end of first postnatal week," see Table Ia.
Swanson (1926)			50.8	30	Minnesota, 1924–25, White, mainly "middle class," full-term, healthy, age 1 week.
Cates and Goodwin (1936)	51.8	345	50.9	327	Measured around 12th day, see Table Ia.
Stuart (1934)	52.1	33	51.5	50	Measured 12th to 14th day, see Table Ia.
	FIRST-BORN INFANTS		INFANTS OF MULTIPARAE		
	Postnatal ages "immediately after birth" to 6 days				
Stockton-Hough (1885)	48.4	423	49.3	289	White infants, "newborn," see Table Ia.
Riggs (1904)	48.5	196	48.9	168	Negro infants, measured "within an hour," see Table Ia.
Riggs (1904)	49.7	370	50.0	227	White infants, measured "within an hour," see Table Ia.
Benedict and Talbot (1915)	50.1	38	50.9	61	White infants, measured "at birth," see Table Ia.
Bakwin and Bakwin (1934)	50.1	812	50.5	841	"Caucasian new-borns," see Table Ia.
Meredith and Brown (1937)	50.2	413	50.7	627	Measured "first hour," see Table Ia.

TABLE Ic

STATURE OF NEONATES (Centimeters): Standard deviations, coefficients of variation, and selected percentiles for males, females, and both sexes together. See Tables Ia and Ib for data on the size and leading characteristics of each sample.

INVESTIGATOR	STANDARD DEVIATION	COEFFICIENT OF VARIATION	MINIMUM VALUE	PERCENTILES				MAXIMUM VALUE
				10TH	25TH	75TH	90TH	
MALES								
Postnatal ages "immediately after birth" to 6 days								
Stuart (1934)	2.1	4.2	45.0	47.7	49.2	52.2	52.9	54.4
Meredith and Brown (1937)	2.1	4.1	44.0	48.5	49.5	52.2	53.6	57.0
Montague and Hollingworth (1914)	3.0	5.9	38.0		48.7	52.5		62.0
Stebbins (1933)	1.8	3.6	46.9		48.8	51.5		54.5
Tiber (1930)					49.6	52.3		
Taylor (1919)	2.1	4.1	45.2					57.0
Freeman and Platt (1932) (Negro and White)	2.0	4.0	43.3					55.0
Bakwin and Bakwin (1934)	2.0	4.0						
Gunstad and Treloar (1936) (Public hospital cases)	2.6	5.2						
Gunstad and Treloar (1936) (Private cases)	2.9	5.8						
Simmons and Todd (1938)	2.7	5.4						
Boyd (1941)	1.7	3.3						

			Postnatal ages 7 to 14 days					
Stuart (1934)	2.0	3.8	47.0	49.2	51.1	53.5	54.7	55.6
Stebbins (1933)	1.8	3.5	47.6		50.0	52.7		56.4
Richdorf (1925)	1.6	3.1			50.5	52.6		
Tiber (1930)					50.0	52.9		
Freeman and Platt (1932)	2.1	4.3	43.8					54.0
Cates and Goodwin (1936)	2.0	3.9	46.5					58.0
			FEMALES					
			Postnatal ages "immediately after birth" to 6 days					
Stuart (1934)	2.0	4.0	45.6	47.2	48.8	51.0	52.2	55.6
Meredith and Brown (1937)	2.0	4.0	45.0	47.8	48.8	51.5	52.9	57.5
Montague and Hollingworth (1914)	2.9	5.9	35.0		48.1	51.8		59.0
Stebbins (1933)	1.5	3.1	45.6		48.2	50.2		51.9
Tiber (1930)					48.7	50.9		
Taylor (1919)	2.1	4.1	45.0					56.6
Freeman and Platt (1932) (Negro and White)	1.9	3.9	45.2					53.8
Bakwin and Bakwin (1934)	1.9	3.9						
Gunstad and Treloar (1936) (Public hospital cases)	2.5	5.1						
Gunstad and Treloar (1936) (Private cases)	3.6	7.1						
Simmons and Todd (1938)	2.3	4.7						
Boyd (1941)	2.2	4.4						

TABLE Ic—(Continued)

INVESTIGATOR	STANDARD DEVIATION	COEFFICIENT OF VARIATION	MINIMUM VALUE	PERCENTILES 10TH	PERCENTILES 25TH	PERCENTILES 75TH	PERCENTILES 90TH	MAXIMUM VALUE
FEMALES								
Postnatal ages 7 to 14 days								
Stuart (1934)	2.3	4.5	46.8	48.5	49.9	52.8	54.0	58.6
Stebbins (1933)	1.5	2.9	47.1		49.2	51.3		52.5
Richdorf (1925)	1.0	1.9			50.5	52.0		
Tiber (1930)					49.4	51.4		
Freeman and Platt (1932)	2.3	4.6	44.6					56.1
Cates and Goodwin (1936)	1.9	3.7	46.0					57.5
BOTH SEXES								
Postnatal ages "immediately after birth" to 6 days								
Meredith and Goodman (1941)	1.6	3.2	45.5		49.5	51.4		54.3
Benedict and Talbot (1915)			46.0					54.5
Meyer (1915): White			40.0					59.0
Negro			34.0					58.0
Adair and Scammon (1921)			42.0					55.0
Ito (1936)			44.5					55.0

TABLE II

STATURE AT AGE ONE MONTH (Centimeters): Central tendency and variability values from sixteen studies of vertex-heel length, together with an intemization of the leading characteristics of each sample.

Investigator	Both Sexes		State	Period	Ancestry	Other Characteristics of Sample
	Average	Cases				
Coppoletta and Wolbach (1933)	52.0	30	Massachusetts	1914–1929	. . .	Cadavera—not considered premature, physically abnormal or diseased.
Freeman and Platt (1932)	53.3	104	New York	. . .	White and Negro	Subjects "normal," 70% White.
Law and Frederick (1938)	53.3	16	Michigan	. . .	. . .	Hospitalized for correction of minor physical defects, "in good health."
Maresh and Washburn (1938)	53.5	50	Colorado	1932–1937	North European	Mainly middle and upper classes, characterized as "average healthy."
Iowa Child Welfare Research Station (1931)	53.6	33	Iowa	1920–1929	Mainly North European	Data obtained in various urban areas of east-central Iowa.
Jeans and Stearns (1938)	53.6	7	Iowa	1936–1937	White	Clinically normal infants.
Rude (1922)	53.9	36	Indiana	1918	Mainly Slavic and British	Annual income below $1500 for 60%, data obtained at health conferences.
Davenport (1938)	54.1	34	New York	1933–1936	White	Mainly from North European stocks, some of Italian ancestry, "normal."
Raiford (1938)[1]	54.1	252	Michigan	1933–1936	White and Negro	Of "indigent and near-indigent classes," full-term, nontwin, well, majority White.
Benedict and Talbot (1921)	54.4	14	Massachusetts	1915–1917	White	"Offspring of resident normal wet-nurses," mostly breast-fed, "clinically normal."

Bayley and Davis (1935)	54.4	50	California	1928–1930	Mainly North European	Mean family income $2844 yearly, subjects reasonably healthy and well nourished.
Richdorf (1925)	54.5	50	Minnesota	. . .	Mainly North European	Middle and upper classes, under medical guidance, largely breast-fed.
Peatman and Higgons (1938)	54.5	279	New York and Connecticut	. . .	White	Annual income over $3000 for 60%, under pediatric guidance.
Baldwin (1921)	54.9	. . .	New York	. . .	Probably White	Data on "private cases furnished by Dr. Freeman."
Woodbury (1921)	55.1	3929	Numerous	1918–1919	White	Predominantly from eastern and north-central states and North European stocks.
Baldwin (1921)	55.3	857	Iowa	1918–1919	Mainly North European	Iowa portion of "Children's Year" data for ages "birth" to two months.

	MALES		FEMALES		
	AVERAGE	NUMBER	AVERAGE	NUMBER	
Freeman and Platt (1932)	53.2	48	53.4	56	See above.
Maresh and Washburn (1938)	53.9	28	52.9	22	See above.
Raiford (1938)	54.5	144	53.5	108	See above.
Richdorf (1925)	54.7	25	54.3	25	See above.
Iowa Child Welfare Research Station (1931)	54.7	17	52.4	16	See above.
Baldwin (1921)	54.9	. . .	54.8	. . .	New York, probably White, "private cases furnished by Dr. Freeman."

TABLE II—(Continued)

INVESTIGATOR	AVERAGE	NUMBER	AVERAGE	NUMBER	OTHER CHARACTERISTICS OF SAMPLE
	MALES		FEMALES		
Peatman and Higgons (1938)	54.9	150	54.1	129	See above.
Benedict and Talbot (1921)	55.1	8	53.5	6	See above.
Rude (1922)	55.2	13	53.0	23	See above.
Bayley and Davis (1935)	55.5	24	53.4	26	See above.
Baldwin (1921)	55.7	460	54.8	397	Iowa portion of "Children's Year" data.
Woodbury (1921)	55.7	2026	54.4	1903	See above.

	STANDARD DEVIATION	COEFFICIENT OF VARIATION	MINIMUM VALUE	PERCENTILES		MAXIMUM VALUE
				25TH	75TH	
			MALES			
Woodbury (1921)	3.7	6.6	41.0	53.3	58.3	71.0
Freeman and Platt (1932)	2.2	4.0	47.0			59.8
Maresh and Washburn (1938)			50.0			60.5
Iowa Child Welfare Research Station (1931)	2.3	4.1				
Bayley and Davis (1935)	2.3	4.2				
Peatman and Higgons (1939)	2.2	4.0				

			FEMALES			
Woodbury (1921)	3.6	6.6	41.0	52.1	56.8	71.0
Freeman and Platt (1932)	1.9	3.6	49.8			57.8
Maresh and Washburn (1938)			48.3			58.0
Iowa Child Welfare Research Station (1931)	2.5	4.8				
Bayley and Davis (1935)	2.4	4.5				
Peatman and Higgons (1939)	2.3	4.3				

---

[1] See also Slyker, Hamil, Poole, Cooley and Macy (1937) and Hamil, Reynolds, Poole and Macy (1938).

TABLE IIIa

STATURE AT AGE THREE MONTHS (Centimeters): Central tendency (mean or median) values from forty-one analyses of data for vertex-heel length taken in dorsal recumbency on infants of both sexes. Each value is supplemented with an itemization of major characteristics of the sample.

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Grover (1915)	55.2	16	Massachusetts	Before 1915	Probably White	Mostly "out-patients," some "private," some "bed patients"; all "normal."
Chapin (1894)	56.6	27	New York	c.1894	Probably White	"Malnourished . . . below par," data taken with an infant measuring board.
Coppoletta and Wolbach (1933)	57.0	44	Massachusetts	1914–1929	. . .	Cadavera—not considered premature, abnormal or diseased.
Bakwin, Bakwin, and Milgram (1934)[1]	58.3	130	New York	c.1929–1934	"Caucasian," mainly Irish	From lower classes (family income $15 to $22 weekly), diet "inadequate."
Law and Frederick (1938)	58.5	10	Michigan	. . .	. . .	Hospitalized for correction of minor physical defects, "in good health."
Blatt, Harris, Jacobs and Zeldes (1940)[2]	58.9	37	Illinois	1937–1940	. . .	"Full-term"; fed "unboiled, pasteurized, enzyme treated milk" from 1st. month.
Freeman (1933)	58.9	89	New York	. . .	Mixed, some Negro	Drawn from infant asylums in New York City.
Woodbury (1921)	58.9	875	New York and others	1918–1919	Italian	Mothers born in Italy, socio-economic status probably below average.
Woodbury (1921)	59.1	301	Southern and eastern	1918–1919	Negro	Considered to represent a socio-economic level somewhat below average.
Woodbury (1921)	59.3	2790	New York	1918–1919	White	Predominantly of Italian and Jewish descent, parents only 23% native-born.
Francis (1940)	59.8	100	Ohio	c.1931–1939	White	Mainly upper classes, 50% breast-fed, "received cod liver oil and oragne juice from an early age."

Poole, Hamil, Cooley and Macy (1938)	59.8	138	Michigan	1934–1936	White and Negro	Lower classes, supervised, from about 5 weeks fed a basal diet[3], cod liver oil, and vegetable soup with wheat germ.
Richdorf (1925)	59.8	100	Minnesota	. . .	Mainly North European	Middle and upper classes; prescribed breast milk, orange juice, cod liver oil.
Slyker, Hamil, Poole, Cooley and Macy (1937)	59.8	c.55	Michigan	1933–1936	White and Negro	Lower classes, supervised, fed a basal diet[3] without vitamin D or B supplement.
Maresh and Washburn (1938)	59.9	66	Colorado	1932–1937	North European	Mainly middle and upper classes, characterized as "average healthy."
Rude (1922)	59.9	85	Indiana	1918	Mainly Slavic and British	Annual income below $1500 for 60%, data obtained at health conferences
Slyker, Hamil, Poole Cooley and Macy (1937)	59.9	c.70	Michigan	1933–1936	White and Negro	Lower classes, supervised; fed a basal diet[3] and 125 U.S.P. units vitamin D daily.
Stuart (1934)	59.9	119	Massachusetts	1930–1934	North European	Mainly middle classes, 50% Irish descent, none "sick or clinically abnormal."
Bakwin, Bakwin and Milgram (1934)	60.0	150	New York	c.1929–1934	"Caucasian," mostly Irish	Lower classes, given advice on infant care at a clinic, supplied cod liver oil.
Bakwin, Bakwin and Milgram (1934)[4]	60.0	218	New York	c.1929–1934	"Caucasian"	Middle classes, advised at clinic on infant care, prescribed cod liver oil and orange juice from 3 weeks of age.
Poole, Hamil, Cooley and Macy (1937)	60.0	66	Michigan	1934–1935	White and Negro	Lower classes; supervised; from about 5 weeks fed a basal diet[3], cod liver oil, and "a water extract of rice polishings."
Hamil, Reynolds, Poole and Macy (1938)[5]	60.2	393	Michigan	1933–1936	White and Negro	Lower classes; supervised; from about 5 weeks fed a basal diet[3], majority given some vitamin D or B supplement.
Benedict and Talbot (1921)	60.3	26	Massachusetts	1915–1917	White	"Offspring of resident normal wet-nurses," "clinically normal," mostly breast-fed.

TABLE IIIa—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Slyker, Hamil, Poole Cooley and Macy (1937)	60.3	c.270	Michigan	1933–1936	White and Negro	Lower classes; supervised; fed a basal diet[3] and 650 U.S.P. units vitamin D daily.
Simmons and Todd (1938)	60.4	253	Ohio	1931–1937	North European	80% from upper classes, "healthy," under "efficient" medical guidance.
Baldwin, Fillmore and Hadley (1930)	60.5	33	Iowa	1923–1926	North European	Subjects resided in rural areas of east-central Iowa.
Woodbury (1921)	60.5	7046	Numerous	1918–1919	White	Predominantly from eastern and north-central states and North European stocks.
Elias and Turner (1936)[5]	60.6	56	New York	1933–1935	White	Lower classes, prescribed "whole milk, dextrimaltose with added wheat germ and yeast," orange juice, cod liver oil.
Jeans and Stearns (1938)	60.6	7	Iowa	1936–1937	White	Under "controlled conditions of housing and diet" from 1st month, fed 1800–4600 U.S.P. units of vitamin D daily.
Bayley and Davis (1935)	60.7	61	California	1928–1931	Mainly North European	Mean family income $2844 yearly, reasonably healthy and well nourished.
Gesell and Thompson (1938)	60.7	25	Connecticut	1927–1931	North European	Of "middle socio-economic status," full-term, "physically normal," healthy.
Woodbury (1921)	60.7	158	Several	1918–1919	German	Mothers born in Germany, no infants showing symptoms of sickness included.
Woodbury (1921)	60.7	674	California	1918–1919	White	Parents 62% native-born, infants free from gross defect and signs of illness.
Iowa Child Welfare Research Station (1931)	60.9	34	Iowa	1920–1929	Mainly North European	Data obtained in various urban areas of east-central Iowa.

Meredith (1935) and Boynton (1936)	60.9	98	Iowa	1926–1935	Mainly North European	Iowa City residents, over 50% from professional and managerial classes.
Peatman and Higgons (1938)	60.9	343	New York and Connecticut	. . .	White	Annual income over $3000 for 60%; given "reasonably optimum" pediatric care; orange juice and cod liver oil at 4 weeks.
Woodbury (1921)[7]	60.9	1486	Iowa	1918–1919	Mainly North European	Parents 82% native-born, infants free of gross defect and signs of illness.
Meredith (1940)	61.0	105	Iowa	1930–1939	North European	Exclusively from professional and managerial classes.
Woodbury (1921)	61.6	154	Several	1918–1919	Scandinavian	Mothers born in Norway, Sweden, Denmark; infants free from illness.
Baldwin (1921)	61.7	. . .	New York	. . .	Probably White	Data on "private cases furnished by Dr. Freeman."
Freeman (1914)	62.3	c.30	New York	Before 1914	Probably White	Cases given pediatric guidance covering diet, rest, fresh air and exercise.

---

[1] See also Bakwin and Bakwin (1931).

[2] Twenty control cases gave a mean of 59.2 cm.

[3] "Evaporated milk, water and corn syrup acidified by the addition of commercially dehydrated lemon juice powder."

[4] See also Bakwin and Bakwin (1931, '36).

[5] See also Raiford (1938).

[6] Fifty-two control cases not given wheat germ and brewer's yeast supplement gave a mean of 60.3 cm.

[7] See also Baldwin (1921).

TABLE IIIb

STATURE AT AGE THREE MONTHS (Centimeters): Mean or median values for vertex-heel length taken in dorsal recumbency on infants of each sex.

INVESTIGATOR	AVERAGE	NUMBER	AVERAGE	NUMBER	MAJOR CHARACTERISTICS OF SAMPLE
	MALES		FEMALES		
Grover (1915)	55.2	7	55.2	9	See Table IIIa.
Bakwin, Bakwin and Milgram (1934)	58.9	78	57.5	52	"Well" infants of a "poverty-stricken" area, many on an "inadequate" diet, see Table IIIa.
Rhoads, Rapoport, Kennedy and Stokes (1941)	59.0	99			Pennsylvania; 1936–40; Negro; mainly "lower income groups"; supervised from 6 weeks—supplied evaporated milk, vitamins A, C, D.
Freeman (1933)	59.2	50	58.6	39	See Table IIIa.
Rhoads Rapoport, Kennedy and Stokes (1941)	59.4	134			Pennsylvania, 1936–40, White infants, similar to Negro sample described above.
Woodbury (1921)	59.4	469	58.3	406	"Children's Year" data, mothers born in Italy, many from lower classes, see Table IIIa.
Woodbury (1921)	59.6	152	58.5	149	Negro infants, socio-economic level considered below average, see Table IIIa.
Woodbury (1921)	59.8	1443	58.7	1266	New York City residents, White, see Table IIIa.
Jeans and Stearns (1936)	59.9	12			Iowa; 1930–33; White; under controlled conditions from around 6 weeks; fed milk with dextrin-maltose (mostly curded), orange juice, cod liver oil.

Bakwin, Bakwin and Milgram (1934)[1]	60.3	117	59.6	101	White infants of "moderate income" families, advised at a "well baby clinic," see Table IIIa.
Stearns, Jeans and Vandecar (1936)	60.3	35			Iowa, 1930-36, White, "well male infants" on controlled diet from 3 weeks, fed orange juice and 340–400 U.S.P. units of vitamin D daily.
Maresh and Washburn (1938)	60.3	38	59.3	28	See Table IIIa.
Bakwin, Bakwin and Milgram (1934)	60.5	93	59.3	57	White infants of a "poverty-stricken" area, advised, supplied cod liver oil, see Table IIIa.
Rude (1922)	60.5	44	59.2	41	See Table IIIa.
Francis (1940)	60.7	50	59.0	50	See Table IIIa.
Richdorf (1925)	60.7	50	58.8	50	See Table IIIa.
Benedict and Talbot (1921)	60.8	13	59.7	13	See Table IIIa.
Raiford (1938)	60.8	240	59.3	186	Michigan; 1933–36; White and Negro; "indigent and near-indigent classes"; supervised diet—evaporated milk, varied vitamin supplements.
Stuart (1934)	60.8	50	59.2	69	See Table IIIa.
Woodbury (1921)	60.8	81	60.6	77	Mothers born in Germany, see Table IIIa.
Jeans and Stearns (1938)	61.0	3	60.4	4	See Table IIIa
Woodbury (1921)	61.1	3580	59.8	3466	"Children's Year" data on White infants, from all regions and ethnic subgroups studied.
Simmons and Todd (1938)	61.3	137	59.3	116	See Table IIIa.
Jeans and Stearns (1933)	61.4	9			Iowa; 1930; White; under controlled conditions from 1st month; fed evaporated milk, corn syrup, lactic acid, orange juice, cod liver oil.
Woodbury (1921)	61.4	351	59.9	323	Residents of California, White, see Table IIIa.
Peatman and Higgons (1938)	61.5	183	60.2	160	See Table IIIa.

TABLE IIIb—(Continued)

INVESTIGATOR	AVERAGE	NUMBER	AVERAGE	NUMBER	MAJOR CHARACTERISTICS OF SAMPLE
	MALES		FEMALES		
Iowa Child Welfare Research Station (1931)	61.6	26	59.9	8	See Table IIIa.
Bayley and Davis (1935)	61.7	31	59.7	30	See Table IIIa.
Boynton (1936)			59.9	43	Iowa, 1926–35, over 90% North European, upper and middle classes, no symptoms of illness.
Meredith (1935)	61.7	55			Male counterpart of Boynton's sample.
Woodbury (1921)[2]	61.7	749	60.1	737	"Children's Year" data, residents of Iowa, White, see Table IIIa.
Daniels and Hejinian (1929)	61.8	4			Iowa; White; under controlled conditions from age 2 weeks; fed whole milk, corn syrup, lactic acid, orange juice, cod liver oil.
Gesell and Thompson (1938)	61.8	12	59.6	13	See Table IIIa.
Meredith (1940)	61.8	63	60.0	42	See Table IIIa.
Nelson (1930)	61.8	9			Iowa, White, same controlled diet as described above for Daniels and Hejinian.
Baldwin (1921)	62.3	. . .	61.0	. . .	New York, probably White, "private cases furnished by Dr. Freeman."
Baldwin, Fillmore and Hadley (1930)	62.3	18	58.4	15	See Table IIIa.
Woodbury (1921)	63.2	82	59.7	72	Mothers born in Norway, Sweden and Denmark; see Table IIIa.

---

[1] See also Bakwin and Bakwin (1936).

[2] See also Baldwin (1921).

TABLE IIIc

STATURE AT AGE THREE MONTHS (Centimeters): Standard deviations, coefficients of variation, and selected percentiles for males, females, and both sexes together. See Tables IIIa and IIIb for data on the size and leading characteristics of each sample.

INVESTIGATOR	STANDARD DEVIATION	COEFFICIENT OF VARIATION	MINIMUM VALUE	PERCENTILES				MAXIMUM VALUE
				10TH	25TH	75TH	90TH	
			MALES					
Stuart (1934)	2.0	3.3	57.2	58.2	59.1	62.2	63.5	66.4
Meredith (1940)	2.9	4.7	54.7	57.7	59.8	63.9	65.7	67.6
Woodbury (1921)[1]	3.5	5.6	46.0		58.9	63.5		76.0
Grandprey (1933)[2]				56.9			65.3	
Richdorf (1925)	2.3	3.7			59.4	62.3		
Freeman (1933)	2.5	4.3	53.0					66.5
Gesell and Thompson (1938)	2.1	3.4	58.3					64.6
Maresh and Washburn (1938)			56.3					65.6
Baldwin, Fillmore and Hadley (1930)	4.6	7.4						
Iowa Child Welfare Research Station (1931)	3.4	5.6						
Bakwin, Bakwin and Milgram (1934)[3]	2.8	4.6						
Bakwin, Bakwin and Milgram (1934)[4]	3.3	5.4						
Bakwin, Bakwin and Milgram (1934)[5]	3.4	5.8						
Bayley and Davis (1935)	1.7	2.7						
Simmons and Todd (1938)	1.5	2.5						
Peatman and Higgons (1939)	2.6	4.2						

FEMALES

Stuart (1934)	2.0	3.4	54.4	56.4	57.8	60.7	61.8	65.0
Meredith (1940)	2.7	4.6	52.5	56.2	58.5	61.8	63.4	66.8
Woodbury (1921)[1]	3.4	5.6	46.0		57.6	62.0		74.0
Grandprey (1933)[2]				55.6			63.5	
Richdorf (1925)	2.2	3.8			58.0	60.3		
Freeman (1933)	2.6	4.4	51.2					63.7
Boynton (1936)	3.1	5.2	52.5					68.5
Gesell and Thompson (1938)	2.5	4.2	55.2					62.8
Maresh and Washburn (1938)			53.8					64.3
Baldwin, Fillmore and Hadley (1930)	3.3	5.7						
Bakwin, Bakwin and Milgram (1934)[3]	2.8	4.6						
Bakwin, Bakwin and Milgram (1934)[4]	2.3	3.9						
Bakwin, Bakwin and Milgram (1934)[5]	3.1	5.4						
Bayley and-Davis (1935)	2.2	3.8						
Simmons and Todd (1938)	2.2	3.6						
Peatman and Higgons (1939)	2.4	3.9						

BOTH SEXES

Bayley and Davis (1935)	2.2	3.7	55.8	57.0	59.3	61.9	63.4	65.0
Law and Frederick (1938)			53.7					64.3

---

[1] Based on the "Children's Year" data for Whiteinfants of all ethnic subgroups and geographic regions.

[2] The same data were employed as for the preceding study by Woodbury.

[3] Based on data accumulated at a "well baby clinic" serving a "poverty-stricken" clientele.

[4] Based on data accumulated at a "well baby clinic" serving a "moderate income" clientele. For similar size samples studied at the same clinic, Bakwin and Bakwin (1936) reported standard deviations of 2.7 cm. for males and 2.3 cm. for females.

[5] Based on data for a nonclinic sample drawn from a "poverty-stricken" district.

TABLE IVa

STATURE AT AGE SIX MONTHS (Centimeters): Central tendency (mean or median) values from fifty analyses of data for vertex-heel length taken in dorsal recumbency on infants of both sexes. Each value is supplemented with an itemization of major characteristics of the sample.

Investigator	Average	Cases	State	Period	Ancestry	Other Characteristics of Sample
Chapin (1894)	59.8	9	New York	c.1894	Probably White	"Malnourished. . .below par," data taken with an infant measuring board.
Chaille (1887)	61.0	. . .	Possibly Louisiana	Before 1887	Probably White	"Ordinary . . . healthy" infants.
Coppoletta and Wolbach (1933)	62.0	43	Massachusetts	1914–1929	. . .	Cadavera—not considered premature, physically abnormal or diseased.
Fleischner (1906)	63.2	c.75	New York	Before 1906	. . .	Hospital patients; some premature; rated 25% well-, 40% poorly-nourished.
Grover (1915)	64.0	25	Massachusetts	Before 1915	Probably White	Mostly "out-patients," some "private" cases, some "bed patients," all "normal."
Holt (1897)	64.2	. . .	New York	Before 1897	Probably White	The data were probably accumulated in private practice.
Woodbury (1921)	64.3	820	New York and others	1918–1919	Italian	All mothers born in Italy, socio-economic status probably below average.
Rude (1922)	64.5	96	Indiana	1918	Mainly Slavic and British	Annual income below $1500 for 60%, data obtained at health conferences.
Woodbury (1921)	64.6	279	Southern and eastern	1918–1919	Negro	Considered to represent a socio-economic level somewhat below average.

Blatt and Schapiro (1935)	64.6	c.45	Illinois	1931–1933	Mainly White, few Negro	Institutionalized; "in good health;" fed whole milk, dextrimaltose, orange juice, cod liver oil, cereal at 3 months, vegetables and soups at 5 months.
Freeman (1933)	64.8	77	New York	. . .	Mixed, some Negro	Subjects obtained at various infant asylums in New York City.
Bakwin, Bakwin and Milgram (1934)[1]	64.9	74	New York	c.1929–1934	"Caucasian," mainly Irish	From lower classes, family income $15 to $22 weekly, diet "inadequate."
Law and Frederick (1938)	64.9	11	Michigan	. . .	. . .	Hospitalized for correction of minor physical defects, "in good health."
Woodbury (1921)	65.0	2454	New York	1918–1919	White	Predominantly of Italian and Jewish descent, parents only 23% native-born.
Baldwin, Fillmore and Hadley (1930)	65.3	46	Iowa	1923–1926	North European	Subjects resided in rural areas of east-central Iowa.
Slyker, Hamil, Poole, Cooley and Macy (1937)	65.3	c.50	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet[2] lacking supplementary vitamin D.
Benedict and Talbot (1921)	65.7	24	Massachusetts	1915–1917	White	"Offspring of resident normal wet-nurses," mostly breast-fed, "clinically normal."
Stuart (1934)	66.1	102	Massachusetts	1930–1934	North European	Mainly middle classes; 50% Irish descent; none "sick"; advised on diet and health care.
Woodbury (1921)	66.2	7238	Numerous	1918–1919	White	Predominantly from eastern and north-central states and North European stocks.

TABLE IVa—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Blatt, Harris, Jacobs, and Zeldes (1940)[3]	66.3	11	Illinois	1937–1940	. . .	Institutionalized group; full-term; from 1st month fed "unboiled, pasteurized, enzyme treated milk."
Slyker, Hamil, Poole, Cooley and Macy (1937)	66.3	c.70	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet[2] supplemented with 125 U.S.P. units vitamin D daily from 5 weeks.
Francis (1940)	66.3	100	Ohio	c.1931–1939	White	Mainly upper classes; 50% breast-fed; healthy; from an "early age" received cod liver oil, orange juice, cereal.
Woodbury (1921)	66.4	134	Several	1918–1919	German	Mothers born in Germany, no infants showing symptoms of sickness included.
Richdorf (1925)	66.4	98	Minnesota	. . .	Mainly North European	Middle and upper classes; prescribed breast milk, orange juice, cod liver oil; cereal added 4th to 6th month.
Maresh and Washburn (1938)	66.4	65	Colorado	1932–1937	North European	Mainly middle and upper classes, characterized as "average healthy."
Simmons and Todd (1938)	66.4	279	Ohio	1931–1937	North European	80% from upper classes, "healthy," under "efficient" medical guidance.
Macy (1912)	66.5	c.100	Probably New York	Before 1912	. . .	Sample considered representative for age 6 months.
Elias and Turner (1936)	66.5	64	New York	1933–1935	White	Lower classes, prescribed a diet supplemented with "presumably large quantities of the vitamin B complex."[4]

Poole, Hamil, Cooley and Macy (1937)	66.5	c.60	Michigan	1934–1935	White and Negro	Lower classes, supervised, supplied a diet[2] with added cod liver oil and "a water extract of rice polishings."
Baldwin (1921)	66.6	. . .	New York	. . .	Probably White	Data on "private cases furnished by Dr. Freeman."
Crum (1916)	66.6	435	Numerous	1913–1916	Mainly North European	Infants measured at baby contests and health conferences.
Hamil, Reynolds, Poole and Macy (1938)[5]	66.6	374	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a basal diet[2], majority given vitamin D supplement, some given added vitamin B.
Hess (1916)	66.7	10	New York	c.1915	Probably Jewish	Institutionalized, "normal infants," fed pasteurized milk, orange juice, cereal.
Holt and Howland (1919)	66.7	. . .	New York Maryland(?)	Before 1919	Probably White	"Healthy" infants, probably "private pediatric practice" cases.
Woodbury (1921)[6]	66.7	1510	Iowa	1918–1919	Mainly North European	Parents 82% native-born, infants free from gross defect and signs of illness.
Woodbury (1921)	66.7	782	California	1918–1919	White	Parents 62% native-born, infants free from gross defect and signs of illness.
Woodbury (1921)	66.7	173	Several	1918–1919	Scandinavian	Mothers born in Norway, Sweden or Denmark; infants free from illness.
Gesell and Thompson (1938)	66.7	37	Connecticut	1927–1931	North European	Of "middle socio-economic status," full-term, "physically normal," healthy.
Iowa Child Welfare Research Station (1931)	66.8	80	Iowa	1920–1929	Mainly North European	Data obtained in various urban areas of east-central Iowa.

TABLE IVa—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Bakwin, Bakwin and Milgram (1934)	66.8	83	New York	c.1929–1934	"Caucasian," mostly Irish	Lower classes, given advice on infant care at a clinic, supplied cod liver oil.
Boyd (1941)	66.8	39	Minnesota	. . .	Probably White	Subjects probably drawn from upper and middle classes exclusively.
Slyker, Hamil, Poole Cooley and Macy (1937)	66.9	c.250	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet[2] supplemented with 650 U.S.P. units vitamin D daily from 5 weeks.
Jeans and Stearns (1938)	67.0	4	Iowa	1936–1937	White	Under "controlled conditions of housing and diet" from 1st month, fed 1800–4600 U.S.P. units of vitamin D daily.
Bakwin, Bakwin and Milgram (1934)[7]	67.2	164	New York	c.1929–1934	"Caucasian"	Middle classes; prescribed cod liver oil and orange juice from 3 weeks, egg yolk and vegetable or cereal at 3 months.
Meredith (1935) and Boynton (1936)	67.2	210	Iowa	1926–1935	Mainly North European	Iowa City residents, over 50% from the professional and managerial classes.
Meredith (1940)	67.4	191	Iowa	1930–1939	North European	Drawn exclusively from the professional and managerial classes.
Bayley and Davis (1935)	67.5	58	California	1928–1931	Mainly North European	Mean family income $2844, subjects reasonably healthy and well nourished.
Peatman and Higgons (1938)	67.5	303	New York and Connecticut	. . .	White	Annual income over $3000 for 60%, given orange juice and cod liver oil at 4 weeks, cereal 3rd month, egg yolk and vegetables 4th month, liver at 5 months.

Poole, Hamil, Cooley and Macy (1938)	67.5	c.125	Michigan	1934–1936	White and Negro	Lower classes, supervised, supplied a diet[2] with cod liver oil and vegetable soup plus wheat germ from 2nd month.
Freeman (1914)	68.0	c.30	New York	Before 1914	Probably White	"Well-cared-for"; under pediatric guidance for diet, rest, fresh air, and exercise.

---

[1] See also Bakwin and Bakwin (1931).

[2] Beginning at about five weeks, this consisted of "evaporated milk, water and corn syrup acidified by the addition of commercially dehydrated lemon juice powder." Cereal was added during the fifth month and strained carrots and peas during the sixth.

[3] Seven control cases gave a mean of 67.2 cm.

[4] After the first month, this consisted of "whole milk, dextri-maltose with added wheat germ and yeast," orange juice and cod liver oil. Cereal with added wheat germ and yeast was given from the fourth month. For 59 control cases receiving no supplementary "wheat germ and brewer's yeast" the mean was 67.1 cm.

[5] See also Raiford (1938).

[6] See also Baldwin (1921).

[7] See also Bakwin and Bakwin (1931, '36).

TABLE IVb

STATURE AT AGE SIX MONTHS (Centimeters): Mean or median values for vertex-heel length taken in dorsal recumbency on infants of each sex.

INVESTIGATOR	AVERAGE	NUMBER	AVERAGE	NUMBER	MAJOR CHARACTERISTICS OF SAMPLE
	MALES		FEMALES		
Grover (1915)	64.3	14	63.6	11	See Table IVa.
Holt (1897)	64.8	...	63.6	...	See Table IVa
Woodbury (1921)	65.1	394	63.6	426	"Children's Year" data, mothers born in Italy, many from lower classes, see Table IVa.
Woodbury (1921)	65.2	130	64.1	149	Negro infants, socio-economic level considered below average, see Table IVa.
Bakwin, Bakwin and Milgram (1934)	65.3	42	64.4	32	"Well" infants of a "poverty-stricken" area, many on an "inadequate" diet, see Table IVa.
Rude (1922)	65.5	60	63.2	36	See Table IVa.
Woodbury (1921)	65.9	1261	64.1	1193	New York City residents, White, see Table IVa.
Freeman (1933)	65.9	34	63.9	43	See Table IVa.
Goddard (1912)	66.0	2			Institutionalized "mental defectives."
Rhoads, Rapoport, Kennedy and Stokes (1941)	66.2	134			Pennsylvania, 1936–40, White, mainly "lower income groups," supervised from 6 weeks.[1]
Rhoads, Rapoport, Kennedy and Stokes (1941)	66.2	99			Pennsylvania, 1936–40, Negro males, similar to preceding sample for White males.
Baldwin, Fillmore and Hadley (1930)	66.6	26	63.7	20	See Table IVa.
Richdorf (1925)	66.8	50	66.0	48	See Table IVa.

Woodbury (1921)	67.0	3721	65.4	3517	"Children's Year" data on White infants, from all regions and ethnic subgroups studied.
Francis (1940)	67.0	50	65.6	50	See Table IVa.
Stuart (1934)	67.1	44	65.3	58	See Table IVa.
Maresh and Washburn (1938)	67.1	37	65.5	28	See Table IVa.
Woodbury (1921)	67.2	74	65.5	60	Mothers born in Germany, see Table IVa.
Simmons and Todd (1938)	67.2	147	65.6	132	See Table IVa.
Crum (1916)	67.3	259	65.7	176	See Table IVa.
Holt and Howland (1919)	67.3	. . .	66.0	. . .	See Table IVa.
Benedict and Talbot (1921)	67.3	12	64.0	12	See Table IVa.
Baldwin (1921)	67.4	. . .	65.8	. . .	New York, probably White, "private cases furnished by Dr. Freeman."
Woodbury (1921)[2]	67.5	792	65.8	718	"Children's Year" data, residents of Iowa, White, see Table IVa.
Bakwin, Bakwin and Milgram (1934)	67.5	54	65.8	29	Infants of a "poverty-stricken" area, advised at a clinic, supplied cod liver oil, see Table IVa.
Mohr and Bartelme (1934)	67.5	4			Illinois, 1929–33, White, from "a slightly inferior socio-economic group."
Woodbury (1921)	67.6	406	65.8	376	Residents of California, White, see Table IVa.
Woodbury (1921)	67.7	100	65.6	73	Mothers born in Norway, Sweden and Denmark, see Table IVa.
Iowa Child Welfare Research Station (1931)	67.8	48	65.4	32	See Table IVa.
Bakwin, Bakwin and Milgram (1934)[3]	67.8	85	66.6	79	"Moderate income" families, infants enrolled with a "well baby clinic," see Table IVa.

TABLE IVb—(Continued)

INVESTIGATOR	AVERAGE	NUMBER	AVERAGE	NUMBER	MAJOR CHARACTERISTICS OF SAMPLE
	MALES		FEMALES		
Raiford (1938)	67.8	209	66.0	161	Infants of the "indigent and near-indigent classes"; under dietary supervision; see Hamil, Reynolds, Poole and Macy, Table IVa.
Gesell and Thompson (1938)	67.9	16	65.7	21	See Table IVa.
Boyd (1941)	68.0	24	65.2	15	See Table IVa.
Jeans and Stearns (1938)	68.0	2	66.0	2	See Table IVa.
Stearns, Jeans and Vandecar (1936)	68.3	21			Iowa, 1930–36, White, "well," on controlled diet from 3 weeks, fed orange juice, 370 U.S.P. units of vitamin D daily, egg yolk at 4 months, sieved vegetables at 5 months.
Boynton (1936)			65.9	93	Iowa, 1926–35, over 90% North European, upper and middle classes, no symptoms of illness.
Jeans and Stearns (1933)	68.4	6			Iowa; White; under controlled conditions from 3 weeks; fed evaporated milk, corn syrup, lactic acid, and items listed above after Stearns, Jeans and Vandecar; 1930 data.
Meredith (1935)	68.4	117			Male counterpart of sample described above after Boynton.
Meredith (1940)	68.4	105	66.2	86	See Table IVa.
Bayley and Davis (1935)	68.5	30	66.4	28	See Table IVa.

Jeans and Stearns (1936)	68.6	8			Iowa; 1930–33; White; on controlled diet from around 6 weeks; fed whole or evaporated milk with dextrin-maltose (mostly curded), plus the items above for Stearns, Jeans and Vandecar.
Peatman and Higgons (1938)	68.6	156	66.3	147	See Table IVa.
Daniels and Hejinian (1929)	68.8	4			Iowa; White; under controlled conditions from 3 weeks; fed whole milk, corn syrup, lactic acid, orange juice, cod liver oil; egg yolk added around 4th month.
Nelson (1930)	69.3	8			Same characteristics as for foregoing sample of Daniels and Hejinian.

---

[1] Supplied a diet of evaporated milk, orange or tomato juice, and vitamin D supplement. "Banana and cereal were started at 3 to 4 months, pureed vegetables and fruits at 5 to 6 months."

[2] See also Baldwin (1921).

[3] See also Bakwin and Bakwin (1936).

TABLE IVc

STATURE AT AGE SIX MONTHS (Centimeters): Standard deviations, coefficients of variation, and selected percentiles for males, females, and both sexes together. See Table IVa and IVb for data on the size and leading characteristics of each sample.

Investigator	Standard Deviation	Coefficient of Variation	Minimum Value	Percentiles				Maximum Value
				10th	25th	75th	90th	
MALES								
Stuart (1934)	2.0	3.0	62.3	64.4	65.6	69.0	70.2	70.5
Meredith (1940)	2.8	4.1	62.8	64.7	66.7	70.3	72.4	75.3
Woodbury (1921)[1]	3.8	5.7	53.0		64.8	69.1		84.0
Grandprey (1933)[2]				62.5			71.1	
Richdorf (1925)	2.3	3.5			65.1	68.3		
Freeman (1933)	3.5	5.2	56.0					74.8
Gesell and Thompson (1938)	1.1	1.6	64.9					71.2
Maresh and Washburn (1938)			63.0					73.0
Iowa Child Welfare Research Station (1931)	3.4	5.0						
Bakwin, Bakwin and Milgram (1934)[3]	1.8	2.7						
Bakwin, Bakwin and Milgram (1934)[4]	2.4	4.9						
Bakwin, Bakwin and Milgram (1934)[5]	3.1	4.7						
Bayley and Davis (1935)	2.2	3.2						
Simmons and Todd (1938)	2.3	3.4						
Peatman and Higgons (1939)	2.3	3.3						
Boyd (1941)	1.8	2.6						

				FEMALES				
Stuart (1934)	2.1	3.2	59.4	62.4	63.8	66.8	68.2	69.8
Meredith (1940)	2.5	3.7	58.9	63.2	64.9	67.8	69.2	72.5
Woodbury (1921)[1]	3.9	6.0	53.0		62.9	67.3		84.0
Grandprey (1933)[2]				61.2			69.6	
Richdorf (1925)	2.1	3.1			64.4	67.7		
Freeman (1933)	2.4	3.8	58.8					70.1
Boynton (1936)	2.8	4.2	57.0					72.5
Gesell and Thompson (1938)	2.0	3.1	62.3					69.2
Maresh and Washburn (1938)			61.0					71.8
Iowa Child Welfare Research Station (1931)	2.3	3.6						
Bakwin, Bakwin and Milgram (1934)[3]	2.1	3.1						
Bakwin, Bakwin and Milgram (1934)[4]	2.0	3.0						
Bakwin, Bakwin and Milgram (1934)[5]	3.3	5.0						
Bayley and Davis (1935)	2.1	3.2						
Simmons and Todd (1938)	2.3	3.5						
Peatman and Higgons (1939)	2.4	3.7						
Boyd (1941)	2.4	3.7						
				BOTH SEXES				
Bayley and Davis (1935)	2.5	3.7	62.5	64.2	65.8	69.0	70.7	72.5
Law and Frederick (1938)			54.2					71.6

---

[1] Based on the "Children's Year" data for White infants of all ethnic subgroups and geographic regions.

[2] The same data were employed as for the preceding study by Woodbury.

[3] Based on data accumulated at a "well baby clinic" serving a "poverty-stricken" clientele.

[4] Based on data accumulated at a "well baby clinic" serving a "moderate income" clientele. For similar size samples studied at the same clinic, Bakwin and Bakwin (1936) reported standard deviations of 2.3 cm. for males and 2.0 cm. for females.

[5] Based on data for a nonclinic sample drawn from a "poverty-stricken" district.

TABLE Va

STATURE AT AGE NINE MONTHS (Centimeters): Central tendency (mean or median) values from forty analyses of data for vertex-heel length taken in dorsal recumbency on infants of both sexes. Each value is supplemented with an itemization of major characteristics of the sample.

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Chapin (1894)	65.1	13	New York	c.1894	Probably White	"Malnourished. . .below par," data taken with an infant measuring board.
Coppoletta and Wolbach (1933)	67.0	18	Massachusetts	1914–1929	. . .	Cadavera—not considered premature, physically abnormal or diseased.
Woodbury (1921)	67.7	245	Southern and eastern	1918–1919	Negro	Considered to represent a socio-economic level somewhat below average.
Woodbury (1921)	68.5	668	New York and others	1918–1919	Italian	All mothers born in Italy, socio-economic status probably below average.
Rude (1922)	68.9	78	Indiana	1918	Mainly Slavic and British	Annual income below $1500 for 60%, data obtained at health conferences.
Woodbury (1921)	69.3	1830	New York	1918–1919	White	Predominantly of Italian and Jewish descent, parents only 23% native-born.
Benedict and Talbot (1921)	69.5	19	Massachusetts	1915–1917	White	"Offspring of resident normal wet-nurses," mostly breast-fed, "clinically normal."
Freeman (1933)	69.5	51	New York	. . .	Mixed, some Negro	Subjects obtained at various infant asylums in New York City.
Woodbury (1921)	69.8	129	Several	1918–1919	German	Mothers born in Germany, no infants showing symptoms of sickness included.
Woodbury (1921)	69.9	7152	Numerous	1918–1919	White	Predominantly from eastern and north-central states and North European stocks.
Bakwin, Bakwin and Milgram (1934)[1]	69.9	62	New York	c.1929–1934	"Caucasian," mainly Irish	From lower classes, family income $15 to $22 weekly, diet "inadequate."

Mohr and Bartelme (1934)	70.0	5	Illinois	1929–1933	White	60% North European, from a "slightly inferior socio-economic group."
Baldwin, Fillmore and Hadley (1930)	70.2	60	Iowa	1923–1926	North European	Subjects resided in rural areas of east-central Iowa.
Slyker, Hamil, Poole, Cooley and Macy (1937)	70.3	c.40	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet[2] lacking supplementary vitamin D prior to 8 months.
Woodbury (1921)[3]	70.6	1437	Iowa	1918–1919	Mainly North European	Parents 82% native-born, infants free from gross defect and signs of illness.
Richdorf (1925)	70.6	97	Minnesota	. . .	Mainly North European	Middle and upper classes, prescribed breast milk, orange juice, cod liver oil, cereal around 5th month, vegetables 6th month.
Stuart (1934)	70.7	96	Massachusetts	1930–1934	North European	Mainly middle classes; 50% Irish descent; none "sick"; advised on diet, health care.
Crum (1916)	70.8	394	Numerous	1913–1916	Mainly North European	Infants measured at baby contests and health conferences.
Woodbury (1921)	70.8	155	Several	1918–1919	Scandinavian	Mothers born in Norway, Sweden or Denmark; infants free from illness.
Woodbury (1921)	70.9	755	California	1918–1919	White	Parents 62% native-born, infants free from gross defect and signs of illness.
Maresh and Washburn (1938)	70.9	64	Colorado	1932–1937	North European	Mainly from middle and upper classes, characterized as "average healthy."
Elias and Turner (1936)	71.0	48	New York	1933–1935	White	Lower classes, prescribed a diet supplemented with "presumably large quantities of the vitamin B complex."[4]
Poole, Hamil, Cooley and Macy (1937)	71.0	c.55	Michigan	1934–1935	White and Negro	Lower classes, supervised, supplied a diet[2] with added cod liver oil and "a water extract of rice polishings."

TABLE Va—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Bakwin, Bakwin and Milgram (1934)	71.2	61	New York	c.1929–1934	"Caucasian," mostly Irish	Lower classes, given advice on infant care at a clinic, supplied cod liver oil.
Law and Frederick (1938)	71.2	8	Michigan	. . .	. . .	Hospitalized for correction of minor physical defects, "in good health."
Simmons and Todd (1938)	71.2	292	Ohio	1931–1937	North European	80% from upper classes, "healthy," under "efficient" medical guidance.
Francis (1940)	71.2	100	Ohio	c.1931–1939	White	Mainly upper classes; 50% breast-fed; healthy; from an "early age" received cod liver oil, orange juice, cereal.
Slyker, Hamil, Poole, Cooley and Macy (1937)	71.3	c.60	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet[2] supplemented with 125 U.S.P. units of vitamin D daily from 5 weeks.
Gesell and Thompson (1938)	71.3	37	Connecticut	1927–1931	North European	Of "middle socio-economic status," full-term, "physically normal," healthy.
Iowa Child Welfare Research Station (1931)	71.4	94	Iowa	1920–1929	Mainly North European	Data obtained in various urban areas of east-central Iowa.
Bayley and Davis (1935)	71.6	56	California	1928–1931	Mainly North European	Mean family income $2844 yearly, subjects reasonably healthy and well nourished.
Meredith (1935) and Boynton (1936)	71.6	263	Iowa	1926–1935	Mainly North European	Iowa City residents, over 50% from the professional and managerial classes.
Hamil, Reynolds, Poole, and Macy (1938)[5]	71.7	328	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a basal diet[2], majority given vitamin D supplement, some added vitamin B.
Poole, Hamil, Cooley and Macy (1938)	71.8	c.110	Michigan	1934–1936	White and Negro	Lower classes, supervised, supplied a diet[2] with cod liver oil and vegetable soup plus wheat germ from 2nd month.

Bakwin, Bakwin and Milgram (1934)[6]	72.0	115	New York	c.1929–1934	"Caucasian"	Middle classes, prescribed cod liver oil and orange juice from 3 weeks, egg yolk and vegetable or cereal by 3 months.
Slyker, Hamil, Poole, Cooley and Macy (1937)	72.0	c.220	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet[2] supplemented with 650 U.S.P. units of vitamin D daily from 5 weeks.
Meredith (1940)	72.1	210	Iowa	1930–1939	North European	Drawn exclusively from the professional and managerial classes.
Baldwin (1921)	72.2	. . .	New York	. . .	Probably White	Data on "private cases furnished by Dr. Freeman."
Peatman and Higgons (1938)	72.2	238	New York and Connecticut	. . .	White	Annual income over $3000 for 60%; given orange juice, cod liver oil at 4 weeks, cereal 3rd month, egg yolk, vegetables 4th, liver 6th, and custard 7th month.
Freeman (1914)	73.5	c.30	New York	Before 1914	Probably White	"Well-cared-for"; under pediatric guidance for diet, rest, fresh air, exercise.

---

[1] See also Bakwin and Bakwin (1931)

[2] Beginning at about five weeks, this consisted of "evaporated milk, water and corn syrup acidified by the addition of commercially dehydrated lemon juice powder." Cereal was added during the fifth month, strained carrots and peas during the sixth, prune pulp and apple sauce during the seventh.

[3] See also Baldwin (1921).

[4] After the first month, this consisted of "whole milk, dextri-maltose with added wheat germ and yeast," orange juice and cod liver oil. Cereal with added wheat germ and yeast was given from the fourth month, pureed vegetables, egg yolk and banana from the sixth, stewed fruit and scraped beef during the eighth or ninth. For 45 control cases receiving no supplementary "wheat germ and brewer's yeast" the mean was 71.4 cm.

[5] See also Raiford (1938).

[6] See also Bakwin and Bakwin (1931, '36).

TABLE Vb

STATURE AT AGE NINE MONTHS (Centimeters): Mean or median values for vertex-heel length taken in dorsal recumbency on infants of each sex.

INVESTIGATOR	AVERAGE	NUMBER	AVERAGE	NUMBER	MAJOR CHARACTERISTICS OF SAMPLE
	MALES		FEMALES		
Woodbury (1921)	68.4	110	67.2	135	Negro infants, socio-economic level considered below average, see Table Va.
Woodbury (1921)	69.3	345	67.6	323	"Children's Year" data, mothers born in Italy, many from lower classes, see Table Va.
Rude (1922)	69.5	42	68.1	36	See Table Va.
Woodbury (1921)	70.1	930	68.4	900	New York City residents, White, see Table Va.
Bakwin, Bakwin and Milgram (1934)	70.3	36	69.3	26	"Well" infants of a "poverty-stricken" area, many on an "inadequate" diet, see Table Va.
Freeman (1933)	70.5	19	68.7	32	See Table Va.
Woodbury (1921)	70.6	3606	69.2	3546	"Children's Year" data on White infants, from all regions and ethnic subgroups studied.
Woodbury (1921)	70.8	68	68.6	61	Mothers born in Germany, see Table Va.
Richdorf (1925)	70.8	49	70.3	48	See Table Va.
Rhoads, Rapoport, Kennedy and Stokes (1941)	70.8	134			Pennsylvania, 1936–40, White, mainly "lower income groups," supervised from 6 weeks.[1]
Rhoads, Rapoport, Kennedy and Stokes (1941)	71.1	99			Pennsylvania, 1936–40, Negro males, similar to preceding sample for White males.
Woodbury (1921)[2]	71.3	738	69.8	699	"Children's Year" data, residents of Iowa, White, see Table Va.
Maresh and Washburn (1938)	71.3	36	70.4	28	See Table Va.

Crum (1916)	71.4	211	70.2	183	See Table Va.
Woodbury (1921)	71.4	395	70.3	360	Residents of California, White, see Table Va.
Baldwin, Fillmore and Hadley (1930)	71.5	34	68.7	26	See Table Va.
Stuart (1934)	71.5	42	70.0	54	See Table Va.
Woodbury (1921)	71.6	76	70.1	79	Mothers born in Norway, Sweden or Denmark; see Table Va.
Iowa Child Welfare Research Station (1931)	71.7	53	71.1	41	See Table Va.
Benedict and Talbot (1921)	71.8	8	67.6	11	See Table Va.
Bakwin, Bakwin and Milgram (1934)	71.8	36	70.4	25	Infants of a "poverty-stricken" area, advised at a clinic, supplied cod liver oil, see Table Va.
Gesell and Thompson (1938)	71.9	20	70.5	17	See Table Va.
Simmons and Todd (1938)	72.0	151	70.3	141	See Table Va.
Francis (1940)	72.0	50	70.3	50	See Table Va.
Mohr and Bartelme (1934)	72.5	2	67.9	3	See Table Va.
Raiford (1938)	72.5	175	70.7	136	Infants of the "indigent and near-indigent classes"; under dietary supervision; see Hamil, Reynolds, Poole and Macy, Table Va.
Bakwin, Bakwin and Milgram (1934)[3]	72.7	60	71.3	55	"Moderate income" families, infants enrolled with a "well baby clinic," see Table Va.
Meredith (1935)	72.7	156			Iowa, 1926–34, over 90% North European, upper and middle classes, no symptoms of illness.
Boynton (1936)			70.3	107	Female counterpart of foregoing sample after Meredith.
Bayley and Davis (1935)	72.9	27	70.3	29	See Table Va.

TABLE Vb—(Continued)

INVESTIGATOR	MALES		FEMALES		MAJOR CHARACTERISTICS OF SAMPLE
	AVERAGE	NUMBER	AVERAGE	NUMBER	
Jeans and Stearns (1933)	73.0	6			Iowa; 1930; White; on controlled diet from 3 weeks, fed evaporated milk, corn syrup, lactic acid, orange juice, cod liver oil; egg yolk from 4, vegetables 5, and fruits 6 months.
Meredith (1940)	73.0	109	71.1	101	See Table Va.
Stearns, Jeans and Vandecar (1936)	73.2	14			Iowa; 1930–36; White; "well male infants"; on controlled diet from 3 weeks; fed the items listed above after Jeans and Stearns, with 340–400 U.S.P. units vitamin D daily.
Peatman and Higgons (1938)	73.2	122	71.1	116	See Table Va.
Baldwin (1921)	73.4	. . .	70.9	. . .	New York, probably White, "private cases furnished by Dr. Freeman."
Jeans and Stearns (1936)	75.0	3			Iowa, 1930–33, White, under controlled conditions, fed whole or evaporated milk with dextrin-maltose (mostly curded) and the items as listed above after Jeans and Stearns (1933).
Nelson (1930)	75.1	4			Iowa; White; under controlled conditions from 3 weeks; fed whole milk, corn syrup, lactic acid, orange juice, cod liver oil; egg yolk from 4, vegetables 6, and fruits 7 months.

---

[1] Supplied a diet of evaporated milk, orange or tomato juice, and vitamin D supplement. "Banana and cereal were started at 3 to 4 months, pureed vegetables and fruits at 5 to 6 months, and potato and meat at 8 to 10 months."

[2] See also Baldwin (1921).

[3] See also Bakwin and Bakwin (1936).

TABLE Vc

STATURE AT AGE NINE MONTHS (Centimeters): Standard deviations, coefficients of variation, and selected percentiles for males, females, and both sexes together. See Tables Va and Vb for data on the size and leading characteristics of each sample.

INVESTIGATOR	STANDARD DEVIATION	COEFFICIENT OF VARIATION	MINIMUM VALUE	PERCENTILES				MAXIMUM VALUE
				10TH	25TH	75TH	90TH	
			MALES					
Stuart (1934)	2.1	2.9	68.0	68.8	70.1	73.0	74.9	76.0
Meredith (1940)	2.5	3.4	67.1	69.6	71.4	74.6	75.9	79.5
Woodbury (1921)[1]	3.8	5.4	58.0		68.2	72.7		89.0
Grandprey (1933)[2]				66.0			75.1	
Richdorf (1925)	2.5	3.6			69.3	72.3		
Freeman (1933)	2.4	3.4	66.2					75.0
Gesell and Thompson (1938)	1.8	2.5	69.0					77.1
Maresh and Washburn (1938)			66.5					81.0
Baldwin, Fillmore and Hadley (1930)	4.1	5.7						
Iowa Child Welfare Research Station (1931)	2.8	3.8						
Bakwin, Bakwin and Milgram (1934)[3]	2.8	3.9						
Bakwin, Bakwin and Milgram (1934)[4]	3.1	4.3						
Bakwin, Bakwin and Milgram (1934)[5]	3.4	4.8						
Bayley and Davis (1935)	2.3	3.1						
Simmons and Todd (1938)	2.3	3.1						
Peatman and Higgons (1939)	2.4	3.3						
			FEMALES					
Stuart (1934)	2.2	3.1	64.8	67.0	68.4	71.8	73.2	75.0
Meredith (1940)	2.5	3.5	65.3	67.6	69.2	72.8	74.2	77.5

Woodbury (1921)[1]	3.8	5.5	56.0		66.8	71.2		89.0
Grandprey (1933)[2]				65.0			73.4	
Richdorf (1925)	2.4	3.3			68.4	71.9		
Freeman (1933)	3.0	4.3	60.1					73.9
Boynton (1936)	2.7	3.9	61.2					76.5
Gesell and Thompson (1938)	1.9	2.7	67.7					75.0
Maresh and Washburn (1938)			63.8					77.0
Baldwin, Fillmore and Hadley (1930)	5.1	7.4						
Iowa Child Welfare Research Station (1931)	3.5	4.9						
Bakwin, Bakwin and Milgram (1934)[3]	2.2	3.1						
Bakwin, Bakwin and Milgram (1934)[4]	2.4	3.4						
Bakwin, Bakwin and Milgram (1934)[5]	3.8	5.5						
Bayley and Davis (1935)	2.5	3.6						
Simmons and Todd (1938)	2.6	3.7						
Peatman and Higgons (1939)	2.7	3.9						
				BOTH SEXES				
Bayley and Davis (1935)	2.7	3.8	64.0	68.4	69.2	73.0	75.3	78.0
Law and Frederick (1938)			66.5					73.5

---

[1] Based on the "Children's Year" data for White infants of all ethnic subgroups and geographic regions.

[2] The same data were employed as for the preceding study by Woodbury.

[3] Based on the data accumulated at a "well baby clinic" serving a "moderate income" clientele. For similar size samples

[3] Based on data accumulated at a "well baby clinic" serving a "moderate income" clientele. For similar size samples studied at the same clinic, Bakwin and Bakwin (1936) reported standard deviations of 2.7 cm. for males and 2.2 cm. for females.

[4] Based on data accumulated at a "well baby clinic" serving a "poverty-stricken" clientele.

[5] Based on data for a nonclinic sample drawn from a "poverty-stricken" district.

TABLE VIa

STATURE AT AGE ONE YEAR (Centimeters): Central tendency (mean or median) values from fifty-one analyses of data for vertex-heel length obtained on infants of both sexes. Each value is supplemented with an itemization of major characteristics of the sample.

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Chaille (1887)	68.5	. . .	Possibly Louisiana	Before 1887	Probably White	"Ordinary . . . healthy" infants.
Chapin (1894)	69.3	6	New York	c.1894	Probably White	"Malnourished . . . below par," measured in dorsal recumbency.
Fleischner (1906)	69.7	c.75	New York	Before 1906	. . .	Hospital patients; some premature; rated 25% well, 40% poorly nourished.
Macy (1912)	70.4	c.100	Probably New York	Before 1912	. . .	Sample considered representative for one year of age.
Woodbury (1921)	71.3	182	Southern and eastern	1918–1919	Negro	Considered to represent a socio-economic level somewhat below average.
Woodbury (1921)	71.4	559	New York and others	1918–1919	Italian	All mothers born in Italy, socio-economic status probably below average.
Rude (1922)	71.8	101	Indiana	1918	Mainly Slavic and British	Annual income below $1500 for 60%, data obtained at health conferences.
Blatt and Schapiro (1935)	71.8	c.45	Illinois	1931–1933	Mainly White, few Negro	Institutionalized; "in good health"; fed whole milk, dextrimaltose, orange juice, cod liver oil; cereal at 3, vegetables, soups at 5, eggs, puddings at 9 months.
Woodbury (1921)	72.0	1559	New York	1918–1919	White	Predominantly of Italian and Jewish descent, parents only 23% native-born.

Grover (1915)	72.7	13	Massachusetts	Before 1915	Probably White	Mostly "out-patients," some "private" cases, some "bed patients," all "normal," measured in dorsal recumbency.
Coppoletta and Wolbach (1933)	73.0	11	Massachusetts	1914–1929	. . .	Cadavera—not considered premature, physically abnormal or diseased.
Hess (1916)	73.1	10	New York	c.1915	Probably Jewish	Institutionalized; "normal infants"; fed pasteurized milk, orange juice, cereal.
Woodbury (1921)	73.1	147	Several	1918–1919	German	Mothers born in Germany, no infants showing symptoms of sickness included.
Woodbury (1921)	73.2	6476	Numerous	1918–1919	White	Predominantly from eastern and north-central states and North European stocks.
Bakwin, Bakwin and Milgram (1934)[1]	73.4	52	New York	c.1929–1934	"Caucasian," mainly Irish	Lower classes, family income $15 to $22 weekly, diet "inadequate."
Holt (1897)	73.5	. . .	New York	Before 1897	Probably White	The data were probably accumulated in private practice.
Woodbury (1921)	73.5	155	Several	1918–1919	Scandinavian	Mothers born in Norway, Sweden or Denmark; infants free from illness.
Woodbury (1921)[2]	73.5	1489	Iowa	1918–1919	Mainly North European	Parents 82% native-born, infants free from gross defect and signs of illness.
Baldwin, Fillmore and Hadley (1930)	73.6	59	Iowa	1923–1926	North European	Subjects resided in rural areas of east-central Iowa.
Slyker, Hamil, Poole, Cooley and Macy (1937)	73.6	c.30	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet[3] lacking supplementary vitamin D prior to 8 months.

TABLE VIa—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Benedict and Talbot (1921)	73.8	15	Massachusetts	1915–1917	White	"Offspring of resident normal wet-nurses," mostly breast-fed, "clinically normal."
Crum (1916)	74.0	512	Numerous	1913–1916	Mainly North European	Infants measured at baby contests and health conferences.
Woodbury (1921)	74.0	740	California	1918–1919	White	Parents 62% native-born, infants free from gross defect and signs of illness.
Freeman (1933)	74.1	39	New York	. . .	Mixed, some Negro	Subjects obtained at various infant asylums in New York City.
Holt and Howland (1919)	74.4	. . .	New York, Maryland (?)	Before 1919	Probably White	"Healthy" infants, probably "private pediatric practice" cases.
Iowa Child Welfare Research Station (1931)	74.6	98	Iowa	1920–1929	Mainly North European	Data obtained in various urban areas of east-central Iowa.
Slyker, Hamil, Poole, Cooley and Macy (1937)	74.6	c.45	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet^3 supplemented with 125 U.S.P. units of vitamin D daily from 5 weeks.
Stuart (1934)	74.7	87	Massachusetts	1930–1934	North European	Mainly middle classes, 50% Irish descent, none "sick," advised on diet and health care, measured in recumbent position.
Gesell and Thompson (1938)	74.7	43	Connecticut	1927–1931	North European	Of "middle socio-economic status," full-term, nontwin, "healthy," recumbent.
Maresh and Washburn (1938)	74.8	63	Colorado	1932–1937	North European	Mainly from middle and upper classes, characterized as "average healthy."
Bakwin, Bakwin and Milgram (1934)	75.0	46	New York	c.1929–1934	"Caucasian," mostly Irish	Lower classes, given advice on infant care at a clinic, supplied cod liver oil.

Poole, Hamil, Cooley and Macy (1937)	75.2	c.50	Michigan	1934–1935	White and Negro	Lower classes, supervised, supplied a diet[3] with added cod liver oil and "a water extract of rice polishings" from 5 weeks.
Davenport (1938)	75.2	34	New York	1933–1936	White	Mainly from North European stocks, some of Italian ancestry, "normal," vitamin requirements considered "satisfied."
Simmons and Todd (1938)	75.2	302	Ohio	1931–1937	North European	80% from upper classes, "healthy," under "efficient" medical guidance.
Francis (1940)	75.2	100	Ohio	c.1931–1939	White	Mainly upper classes; "healthy"; 50% breast-fed to 3 months; from "early age" received cod liver oil, orange juice and cereal; "recumbent length" data.
Gray and Ayres (1931)	75.3	30	New York and others	. . .	White	Majority of North European descent, socio-economic level "superior," characterized as "normals in private schools."
Wallis (1931)	75.3	36	New York	1924–1929	White	Parents 90% native-born, economically of "the favored class," recumbency data.
Meredith (1935) and Boynton (1936)	75.5	253	Iowa	1926–1935	Mainly North European	Over 50% from professional and managerial classes; measured recumbent.
Elias and Turner (1936)	75.5	41	New York	1933–1935	White	Lower classes, prescribed a diet supplemented with "presumably large quantities of the vitamin B complex."[4]
Peatman and Higgons (1938)	75.5	296	New York and Connecticut	. . .	White	Annual income over $3000 for 60%, given "reasonably optimal" diet and health care throughout year,[5] recumbency data.

TABLE VIa—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Hamil, Reynolds, Poole and Macy (1938)[6]	75.6	254	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a basal diet,[3] majority given vitamin D supplement, some additional vitamin B.
Sawtell (1929)	75.7	18	New York	1925–1927	White	From homes of "moderate prosperity," infants in dorsal recumbency.
Bakwin, Bakwin and Milgram (1934)[7]	75.7	90	New York	c.1929–1934	"Caucasian"	Middle classes, prescribed cod liver oil and orange juice from 3 weeks, egg yolk and vegetables or cereal by 3 months.
Bayley and Davis (1935)	75.7	56	California	1928–1931	Mainly North European	Mean family income $2844 yearly, subjects reasonably healthy and well nourished, recumbent measurements.
Poole, Hamil, Cooley and Macy (1938)	75.8	101	Michigan	1934–1936	White	Lower classes, supervised, supplied a diet[3] with cod liver oil, majority fed a "vegetable soup reenforced with wheat germ" from the 2nd month.
Slyker, Hamil, Poole, Cooley and Macy (1937)	76.0	c.180	Michigan	1933–1936	White and Negro	Lower classes, supervised, supplied a diet[3] supplemented with 650 U.S.P. units of vitamin D daily from 5 weeks.
Meredith (1940)	76.1	207	Iowa	1930–1939	North European	Drawn exclusively from the professional and managerial classes, recumbent.
Boyd (1941)	76.2	23	Minnesota	. . .	Probably White	Subjects probably drawn from the upper and middle classes exclusively.

Baldwin (1921)	76.3	. . .	New York	. . .	Probably White	Data on "private cases furnished by Dr. Freeman."
Poole, Hamil, Cooley and Macy (1938)	76.5	46	Michigan	1934–1936	Negro	Lower classes, supervised, supplied a diet[3] with cod liver oil, majority fed a "vegetable soup reenforced with wheat germ" from the 2nd month.
Freeman (1914)	78.3	c.30	New York	Before 1914	Probably White	"Well-cared-for"; under pediatric guidance for diet, rest, fresh air and exercise.

---

[1] See also Bakwin and Bakwin (1931).

[2] See also Baldwin (1921).

[3] Beginning at about five weeks, this consisted of "evaporated milk, water and corn syrup acidified by the addition of commercially dehydrated lemon juice powder." Cereal was added during the fifth month, strained carrots and peas during the sixth, prune pulp and apple sauce during the seventh, and eggs during the twelfth.

[4] After the first month, this consisted of "whole milk, dextri-maltose with added wheat germ and yeast," orange juice and cod liver oil. Cereal with added wheat germ and yeast was given from the fourth month ,pureed vegetables, egg yolk and banana from the sixth, stewed fruit and scraped beef from the eighth or ninth. For 29 control cases receiving no supplementary "wheat germ and brewer's yeast" the mean was 74.8 cm.

[5] This included orange juice and cod liver oil from four weeks, cereal from third month, egg yolk and strained vegetables from fourth, liver from sixth, custard from seventh. Ultra-violet radiation was prescribed during the winter months, also "diphtheria toxoid at the age of 8 months" and "a Schick test at 12 months."

[6] See also Raiford (1938).

[7] See also Bakwin and Bakwin (1931, '36).

TABLE VIb

STATURE AT AGE ONE YEAR (Centimeters): Mean or median values for vertex-heel length on infants of each sex.

INVESTIGATOR	AVERAGE	NUMBER	AVERAGE	NUMBER	MAJOR CHARACTERISTICS OF SAMPLE
	MALES		FEMALES		
Woodbury (1921)	71.4	85	71.3	97	Negro infants, socio-economic level considered below average, see Table VIa.
Woodbury (1921)	72.0	276	70.9	283	"Children's Year" data, mothers born in Italy, many from lower classes, see Table VIa.
Grover (1915)	72.5	7	73.0	6	See Table VIa.
Woodbury (1921)	72.5	797	71.4	762	New York City residents, White, see Table VIa.
Rude (1922)	72.5	59	70.9	42	See Table VIa.
Swanson (1926)			71.8	45	Minnesota, 1924–25, parents mainly of North European descent and "middle class," infants full-term, "healthy normal."
Holt (1897)	73.8	. . .	73.2	. . .	See Table VIa.
Woodbury (1921)	73.8	84	72.2	63	Mothers born in Germany, see Table VIa.
Bakwin, Bakwin and Milgram (1934)	73.8	27	72.9	25	"Well" infants of a "poverty-stricken" area, many on an "inadequate" diet, see Table VIa.
Woodbury (1921)	74.0	3413	72.4	3063	"Children's Year" data on White infants, from all regions and ethnic subgroups studied.
Woodbury (1921)	74.2	80	72.8	75	Mothers born in Norway, Sweden or Denmark; see Table VIa.
Woodbury (1921)[1]	74.3	772	72.6	717	"Children's Year" data, residents of Iowa, White, see Table VIa.

Rhoads, Rapoport, Kennedy and Stokes (1941)	74.3	134			Pennsylvania, 1936–40, White, mainly "lower income groups," supervised from 6 weeks.[2]
Baldwin, Fillmore and Hadley (1930)	74.4	36	72.6	23	See Table VIa.
Woodbury (1921)	74.5	401	73.3	339	Residents of California, White, see Table VIa.
Crum (1916)	74.6	284	73.3	228	See Table VIa.
Freeman (1933)	74.8	19	73.4	20	See Table VIa.
Rhoads, Rapoport, Kennedy and Stokes (1941)	74.8	99			Pennsylvania, 1936–40, Negro males, similar to previously described sample of White males.
Holt and Howland (1919)	75.0	. . .	73.7	. . .	See Table VIa.
Gray and Ayres (1931)	75.2	18	75.4	12	See Table VIa.
Iowa Child Welfare Research Station (1931)	75.2	57	73.9	41	See Table VIa.
Wallis (1931)	75.2	21	75.4	15	See Table VIa.
Maresh and Washburn (1938)	75.2	35	74.3	28	See Table VIa.
Benedict and Talbot (1921)	75.7	6	72.3	9	See Table VIa.
Stuart (1934)	75.7	38	73.9	49	See Table VIa.
Gesell and Thompson (1938)	75.8	19	73.7	24	See Table VIa.
Sawtell (1929)	76.0	10	75.2	7	See Table VIa.
Bakwin, Bakwin and Milgram (1934)	76.1	22	74.0	24	Infants of a "poverty-stricken" area, advised at a clinic, supplied cod liver oil, see Table VIa.
Simmons and Todd (1938)	76.1	154	74.2	148	See Table VIa.
Francis (1940)	76.3	50	74.2	50	See Table VIa.
Meredith (1935)	76.5	150			Iowa, 1926–34, over 90% North European, upper and middle classes, no symptoms of illness.

TABLE VIb—(Continued)

Investigator	Males Average	Males Number	Females Average	Females Number	Major Characteristics of Sample
Boynton (1936)			74.4	103	Female counterpart of the preceding male sample after Meredith.
Poole, Hamil, Cooley and Macy (1938)	76.6	60	74.8	41	White infants of "indigent or near-indigent classes," on special diet, see Table VIa.
Raiford (1938)	76.6	136	75.0	91	White and Negro infants of lower classes; under dietary supervision; see Hamil, Reynolds, Poole and Macy, Table VIa.
Peatman and Higgons (1938)	76.7	144	74.4	151	See Table VIa.
Poole, Hamil, Cooley and Macy (1938)	76.7	25	76.3	21	Negro infants of "indigent or near-indigent classes," on special diet, see Table VIa.
Bakwin, Bakwin and Milgram (1934)[3]	76.9	31	74.8	59	"Moderate income" families, infants enrolled with a "well baby clinic," see Table VIa.
Bayley and Davis (1935)	76.9	28	74.5	28	See Table VIa.
Baldwin (1921)	77.1	. . .	75.5	. . .	New York, probably White, "private cases furnished by Dr. Freeman."
Meredith (1940)	77.1	114	75.0	93	See Table VIa.
Boyd (1941)	77.3	15	74.7	8	See Table VIa.

---

[1] See also Baldwin (1921)

[2] Supplied a diet of evaporated milk, orange or tomato juice, and vitamin D supplement. "Banana and cereal were started at 3 to 4 months, pureed vegetables and fruits at 5 to 6 months, and potato and meat at 8 to 10 months."

[3] See also Bakwin and Bakwin (1936).

TABLE VIc

STATURE AT AGE ONE YEAR (Centimeters): Standard deviations, coefficients of variation, and selected percentiles for males, females, and both sexes together. See Tables VIa and VIb for data on the size and leading characteristics of each sample.

Investigator	Standard Deviation	Coefficient of Variation	Minimum Value	Percentiles				Maximum Value
				10th	25th	75th	90th	
			MALES					
Stuart (1934)	2.6	3.4	71.8	72.4	73.7	77.6	79.4	81.1
Meredith (1940)	2.8	3.7	69.7	73.7	75.2	78.7	81.1	84.2
Woodbury (1921)[1]	3.7	4.9	53.0		71.5	76.3		94.0
Grandprey (1933)[2]				69.6			78.7	
Wallis (1931)[3]	4.8	6.4	66.0					84.0
Freeman (1933)	2.2	2.9	70.0					79.5
Gesell and Thompson (1938)	2.0	2.6	72.5					81.0
Maresh and Washburn (1938)			70.0					80.4
Poole, Hamil, Cooley and Macy (1938): White			72.3					81.5
Negro			72.8					80.9
Gray and Ayres (1931)	4.0	5.3						
Iowa Child Welfare Research Station (1931)	3.2	4.2						
Bakwin, Bakwin and Milgram (1934)[4]	2.5	3.2						
Bakwin, Bakwin and Milgram (1934)[5]	2.3	3.0						
Bakwin, Bakwin and Milgram (1934)[6]	3.1	4.2						
Bayley and Davis (1935)	2.5	3.3						
Simmons and Todd (1938)	2.6	3.5						
Peatman and Higgons (1939)	2.6	3.4						
Boyd (1941)	2.1	2.7						

				FEMALES				
Stuart (1934)	2.6	3.5	68.6	70.3	72.3	75.8	77.8	79.0
Meredith (1940)	2.5	3.4	67.5	72.1	73.1	77.0	78.4	80.6
Woodbury (1921)[1]	3.7	5.2	56.0		70.1	74.6		91.0
Grandprey (1933)[2]				67.7			76.7	
Wallis (1931)[3]	5.3	7.0	64.0					87.0
Freeman (1933)	1.8	2.4	69.8					77.0
Boynton (1936)	2.6	3.6	67.5					81.2
Gesell and Thompson (1938)	2.2	2.9	67.8					78.6
Maresh and Washburn (1938)			69.3					78.8
Poole, Hamil, Cooley and Macy (1938): White			70.2					81.5
Negro			71.1					79.9
Gray and Ayres (1931)	4.6	6.0						
Iowa Child Welfare Research Station (1931)	2.6	3.4						
Bakwin, Bakwin and Milgram (1934)[4]	2.2	3.0						
Bakwin, Bakwin and Milgram (1934)[5]	2.8	3.7						
Bakwin, Bakwin and Milgram (1934)[6]	2.7	3.8						
Bayley and Davis (1935)	2.6	3.5						
Simmons and Todd (1938)	2.9	3.8						
Peatman and Higgons (1939)	2.9	3.9						
Boyd (1941)	2.6	3.5						
				BOTH SEXES				
Bayley and Davis (1935)	2.9	3.8	67.5	72.2	73.6	77.6	78.9	81.5
Davenport (1938)	2.3	3.1						

---

[1] Based on the "Children's Year" data for White infants of all ethnic subgroups and geographic regions.

[2] The same data were employed as for the preceding study by Woodbury.

[3] See also Sawtell (1929).

[4] Based on data accumulated at a "well baby clinic" serving a "moderate income" clientele. For similar size samples studied at the same clinic, Bakwin and Bakwin (1936) reported standard deviation of 2.3 cm. for males and 2.2 cm. for females.

[5] Based on data accumulated at a "well baby clinic" serving a "poverty-stricken" clientele.

[6] Based on data for a nonclinic sample drawn from a "poverty-stricken" district.

TABLE VII

STATURE AT AGE FIFTEEN MONTHS (Centimeters): Central tendency and variability values, together with an itemization of the leading characteristics of each sample.

Investigator	Both Sexes		State	Period	Ancestry	Other Characteristics of Sample
	Average	Cases				
Woodbury (1921)	74.3	446	New York and others	1918–1919	Italian	All mothers born in Italy, socio-economic status probably below average.
Rude (1922)	74.8	71	Indiana	1918	Mainly Slavic and British	Annual income below $1500 for 60%, data obtained at health conferences.
Freeman (1933)	74.9	19	New York	. . .	Mixed, some Negro	Subjects obtained at various infant asylums in New York City.
Woodbury (1921)	75.0	131	Southern and eastern	1918–1919	Negro	Considered to represent a socio-economic level somewhat below average.
Woodbury (1921)	75.1	1204	New York	1918–1919	White	Predominantly of Italian and Jewish descent, parents only 23% native-born.
Woodbury (1921)	76.2	5169	Numerous	1918–1919	White	Predominantly from eastern and north-central states and North European stocks.
Woodbury (1921)[1]	76.4	1196	Iowa	1918–1919	Mainly North European	Parents 82% native-born, infants free from gross defect and signs of illness.
Baldwin, Fillmore and Hadley (1930)	76.5	59	Iowa	1923–1926	North European	Subjects resided in rural areas of east-central Iowa.
Woodbury (1921)	76.8	580	California	1918–1919	White	Parents 62% native-born, infants free from gross defect and signs of illness.
Woodbury (1921)	76.8	117	Several	1918–1919	German	Mothers born in Germany, no infants showing symptoms of sickness included.
Woodbury (1921)	76.9	109	Several	1918–1919	Scandinavian	Mothers born in Norway, Sweden or Denmark; infants free from illness.

Crum (1916)	77.3	412	Numerous	1913–1916	Mainly North European	Infants measured at baby contests and health conferences.
Iowa Child Welfare Research Station (1931)	77.7	65	Iowa	1920–1929	Mainly North European	Data obtained in various urban areas of east-central Iowa.
Maresh and Washburn (1938)	78.1	61	Colorado	1932–1937	North European	Mainly from middle and upper classes, characterized as "average healthy."
Peatman and Higgons (1938)	78.7	258	New York and Connecticut	. . .	White	Annual income over $3000 for 60%, given "reasonably optimal" diet and health care throughout year,[2] measured recumbent.
Meredith (1935) and Boynton (1936)	79.0	218	Iowa	1926–1935	Mainly North European	Over 50% from professional and managerial classes, measured recumbent.
Bayley and Davis (1935)	79.2	52	California	1928–1931	Mainly North European	Mean family income $2844 yearly, subjects reasonably healthy and well nourished, recumbent measurements.
Meredith (1940)	79.4	185	Iowa	1930–1939	North European	Drawn exclusively from the professional and managerial classes, measured recumbent.

	MALES		FEMALES		
	AVERAGE	NUMBER	AVERAGE	NUMBER	
Freeman (1933)	75.0	8	74.8	11	See above.
Woodbury (1921)	75.1	221	73.5	225	"Children's Year" data, mothers born in Italy, many from lower classes, see above.
Woodbury (1921)	75.2	53	74.9	78	Negro infants, socio-economic level considered below average, see above.
Rude (1922)	75.2	39	74.3	32	See above.
Woodbury (1921)	75.8	593	74.5	611	New York City residents, White, see above.

TABLE VII—(Continued)

INVESTIGATOR	MALES		FEMALES		OTHER CHARACTERISTICS OF SAMPLE
	AVERAGE	NUMBER	AVERAGE	NUMBER	
Baldwin, Fillmore and Hadley (1930)	76 7	39	76.1	20	See above.
Woodbury (1921)	76.9	2609	75.4	2560	"Children's Year" data on White infants from all regions and ethnic subgroups studied.
Woodbury (1921)[1]	77.1	607	75.7	589	"Children's Year" data, residents of Iowa, White, see above.
Woodbury (1921)	77.3	58	76.3	59	Mothers born in Germany, see above.
Woodbury (1921)	77.4	265	76.2	315	Residents of California, White, see above.
Woodbury (1921)	77.4	55	76.3	54	Mothers born in Norway, Sweden or Denmark; see above.
Crum (1916)	78.1	215	76.5	197	See above.
Iowa Child Welfare Research Station (1931)	78.6	36	76.5	29	See above.
Maresh and Washburn (1938)	78.6	35	77.5	26	See above.
Peatman and Higgons (1938)	79.5	141	77.7	111	See above.
Meredith (1935)	79.6	135			Iowa, 1926–34, over 90% North European, upper and middle classes, no symptoms of illness.
Boynton (1936)			78.2	83	Female counterpart of the preceding male sample after Meredith.
Meredith (1940)	80.1	101	78.6	84	See above.
Bayley and Davis (1935)	80.6	27	77.7	25	See above.

	Standard Deviation	Coefficient of Variation	Minimum Value	Percentiles				Maximum Value
				10th	25th	75th	90th	
MALES								
Meredith (1940)	2.5	3.1	72.8	77.2	78.4	81.9	83.3	85.8
Woodbury (1921)[2]	3.5	4.6	61.0		74.8	79.2		96.0
Grandprey (1933)[3]				72.8			81.7	
Freeman (1933)	1.6	2.1	71.6					77.0
Maresh and Washburn (1938)			74.3					85.0
Baldwin, Fillmore and Hadley (1930)	3.3	4.3						
Iowa Child Welfare Research Station (1931)	2.7	3.4						
Bayley and Davis (1935)	2.9	3.5						
Peatman and Higgons (1939)	2.8	3.6						
FEMALES								
Meredith (1940)	2.7	3.4	72.8	75.1	76.8	80.5	82.6	86.8
Woodbury (1921)[2]	3.7	4.9	58.0		73.0	77.5		96.0
Grandprey (1933)[3]				70.9			79.9	
Freeman (1933)	3.3	4.4	68.9					79.2
Boynton (1936)	2.4	3.1	72.6					82.5
Maresh and Washburn (1938)			72.5					81.8
Baldwin, Fillmore and Hadley (1930)	3.9	5.1						
Iowa Child Welfare Research Station (1931)	2.5	3.3						
Bayley and Davis (1935)	2.8	3.6						
Peatman and Higgons (1939)	2.8	3.6						
BOTH SEXES								
Bayley and Davis (1935)	3.2	4.0	69.5	75.1	76.8	81.1	82.9	86.5

---

[1] See also Baldwin (1921).

[2] Based on the "Children's Year" data for White infants of all ethnic subgroups and geographic regions.

[3] The same data were employed as for the preceding study by Woodbury.

TABLE VIIIa

STATURE AT AGE EIGHTEEN MONTHS (Centimeters): Central tendency (mean or median) values from thirty-eight analyses of data on infants of both sexes. Each value is supplemented with an itemization of major characteristics of the sample.

Investigator	Average	Cases	State	Period	Ancestry	Other Characteristics of Sample
Bowditch (1872)	72.4	15	Massachusetts (?)	c.1850	White	Parents "American," of professional classes, infants all "nearly related."
Goddard (1912)	74.8	8	. . .	Before 1912	Probably White	Institutionalized as "mental defectives."
Peckham (1882)	75.1	61	Wisconsin	c.1881	Mainly German	Parents predominantly American or German-born.
Chapin (1894)	75.7	14	New York	c.1894	Probably White	"Malnourished . . . below par," measured in dorsal recumbency.
Macy (1912)	75.7	c.100	Probably New York	Before 1912	. . .	Sample considered representative for 18 months of age.
Holt (1897)	76.0	. . .	New York	Before 1897	Probably White	The data were probably accumulated in private practice.
Blatt and Schapiro (1935)	76.4	c.45	Illinois	1931–1933	Mainly White, few Negro	Institutionalized, "in good health," fed a special diet,[1] 50% given cereal with enriched mineral content.
Woodbury (1921)	77.3	408	New York and others	1918–1919	Italian	All mothers born in Italy, socio-economic status probably below average.
Woodbury (1921)	77.4	146	Southern and eastern	1918–1919	Negro	Considered to represent a socio-economic level somewhat below average.
Gebhart (1924)	77.5	106	New York	. . .	Italian	Residents of "a congested Italian district," "apparently well."

Rude (1922)	77.6	82	Indiana	1918	Mainly Slavic and British	Annual income below $1500 for 60%, data obtained at health conferences.
Woodbury (1921)	77.8	1044	New York	1918–1919	White	Predominantly of Italian and Jewish descent, parents only 23% native-born.
Coppoletta and Wolbach (1933)	78.0	22	Massachusetts	1914–1929	. . .	Cadavera—not considered premature, physically abnormal or diseased.
Hess (1916)	78.3	10	New York	c.1915	Probably Jewish	Institutionalized, "normal infants," fed pasteurized milk, orange juice, cereal.
Grover (1915)	78.6	12	Massachusetts	Before 1915	Probably White	Mostly "out-patients," some "private" cases, some "bed patients," all "normal," measured in dorsal recumbency.
Benedict and Talbot (1921)	78.7	12	Massachusetts	1915–1917	White	"Offspring of resident normal wet-nurses," mostly breast-fed, "clinically normal."
Freeman (1933)	79.1	24	New York	. . .	Mixed, some Negro	Subjects obtained at various infant asylums in New York City.
Woodbury (1921)[2]	79.3	1213	Iowa	1918–1919	Mainly North European	Parents 82% native-born, infants free from gross defect and signs of illness.
Woodbury (1921)	79.3	111	Several	1918–1919	German	Mothers born in Germany, no infants showing symptoms of sickness included.
Woodbury (1921)	79.4	5014	Numerous	1918–1919	White	Predominantly from eastern and north-central states and North European stocks.
Holt and Howland (1926)	79.4	. . .	New York, Maryland (?)	. .	Probably White	"Healthy" infants, probably "private pediatric practice" cases.
Crum (1916)	79.9	359	Numerous	1913–1916	Mainly North European	Infants measured at baby contests and health conferences.

TABLE VIIIa—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Woodbury (1921)	79.9	120	Several	1918–1919	Scandinavian	Mothers born in Norway, Sweden or Denmark; infants free from illness.
Woodbury (1921)	80.0	548	California	1918–1919	White	Parents 62% native-born, infants free from gross defect and signs of illness.
Baldwin, Fillmore and Hadley (1930)	80.0	56	Iowa	1923–1926	North European	Subjects resided in rural areas of east-central Iowa.
Mohr and Bartelme (1934)	80.0	51	Illinois	1929–1933	White, 60% North European	Premature infants (1000–2500 gm. at birth), from "a slightly inferior socio-economic group," given "excellent" postnatal care and supervision.
Holt and Howland (1919)	80.5	. . .	New York, Maryland (?)	Before 1919	Probably White	"Healthy" infants, probably "private pediatric practice" cases.
Iowa Child Welfare Research Station (1931)	80.9	72	Iowa	1920–1929	Mainly North European	Data obtained in various urban areas of east-central Iowa.
Maresh and Washburn (1938)	81.3	59	Colorado	1932–1937	North European	Mainly from middle and upper classes, characterized as "average healthy."
Simmons and Todd (1938)	81.4	301	Ohio	1931–1937	North European	80% from upper classes, "healthy," under "efficient" medical guidance, stature measured erect but "not against a wall."
Peatman and Higgons (1938)	81.5	214	New York and Connecticut	. . .	White	Annual income over $3000 for 60%, given "reasonably optimal" diet and health care from birth,[3] measured recumbent.

Stuart (1934)	81.7	78	Massachusetts	1930–1934	North European	Mainly middle classes, 50% Irish descent, none "sick," advised on diet and health care, measured in recumbent position.
Mohr and Bartelme (1934)	81.8	12	Illinois	1929–1933	White	60% North European, from "a slightly inferior socio-economic group."
Bayley and Davis (1935)	82.0	47	California	1928–1931	Mainly North European	Mean family income $2844, subjects reasonably healthy and well nourished.
Meredith (1935) and Boynton (1936)	82.5	192	Iowa	1926–1935	Mainly North European	Over 50% from professional and managerial classes.
Baldwin (1921)	82.7	. . .	New York	. . .	Probably White	Data on "private cases furnished by Dr. Freeman."
Meredith (1940)	82.7	202	Iowa	1930–1939	North European	Drawn exclusively from the professional and managerial classes.
Boyd (1941)	82.9	22	Minnesota	. . .	Probably White	Subjects probably drawn from the upper and middle classes exclusively.

---

[1] This consisted of whole milk, dextrimaltose, orange juice, cod liver oil, cereal, vegetables and soups. Eggs and puddings were added by the ninth month. By one year the diet also included toast, bacon, and stewed fruits. The subjects were "observed for periods varying from 6 weeks to 1 year."

[2] See also Baldwin (1921).

[3] This included orange juice and cod liver oil from four weeks, cereal from third month, egg yolk and strained vegetables from fourth, liver from sixth, custard from seventh. Ultra-violet radiation was prescribed during the winter months, also "diphtheria toxoid at the age of 8 months, a Schick test at 12 months, pertussis vaccine (Sauer) at from 12 to 15 months."

TABLE VIIIb

STATURE AT AGE EIGHTEEN MONTHS (Centimeters): Mean or median values for infants of each sex.

Investigator	Males Average	Males Number	Females Average	Females Number	Major Characteristics of Sample
Goddard (1912)	71.1	6	78.7	2	Infants institutionalized as "mental defectives," probably White, see Table VIIIa.
Bowditch (1872)	73.9	8	70.8	7	From professional classes, close relatives, see Table VIIIa.
Peckham (1882)	74.9	25	75.2	36	See Table VIIIa.
Holt (1897)	76.3	. . .	75.6	. . .	See Table VIIIa.
Gebhart (1924)	77.2	53	77.8	53	Residents of "a congested Italian district," see Table VIIIa.
Woodbury (1921)	78.1	217	76.4	191	"Children's Year" data, mothers born in Italy, many from lower classes, see Table VIIIa.
Woodbury (1921)	78.1	71	76.7	75	Negro infants, socio-economic level considered below average, see Table VIIIa.
Woodbury (1921)	78.2	548	77.4	496	New York City residents, White, see Table VIIIa.
Grover (1915)	78.6	6	78.7	5	See Table VIIIa.
Rude (1922)	79.0	35	76.5	47	See Table VIIIa.
Benedict and Talbot (1921)	79.9	6	77.5	6	See Table VIIIa.
Woodbury (1921)[1]	79.9	614	78.7	599	"Children's Year" data, residents of Iowa, White, see Table VIIIa.
Woodbury (1921)	80.0	2567	78.7	2447	"Children's Year" data on White infants from all regions and ethnic subgroups studied.
Woodbury (1921)	80.0	60	78.4	51	Mothers born in Germany, see Table VIIIa.
Holt and Howland (1926)	80.0	. . .	78.8		See Table VIIIa.
Mohr and Bartelme (1934)	80.1	22	80.0	29	Premature infants, see Table VIIIa.
Freeman (1933)	80.3	14	77.6	10	See Table VIIIa.
Crum (1916)	80.6	181	79.1	178	See Table VIIIa.

Baldwin, Fillmore and Hadley (1930)	80.7	34	79.2	22	See Table VIIIa.
Rhoads, Rapoport, Kennedy and Stokes (1941)	80.7	134			Pennsylvania, 1936–40, White, mainly "lower income groups," supervised from 6 weeks.[2]
Woodbury (1921)	80.9	297	79.1	251	Residents of California, White, see Table VIIIa.
Woodbury (1921)	81.1	61	78.7	59	Mothers born in Norway, Sweden or Denmark; see Table VIIIa.
Holt and Howland (1919)	81.2	. . .	79.8	. . .	See Table VIIIa.
Rhoads, Rapoport, Kennedy and Stokes (1941)	81.2	99			Pennsylvania, 1936–40, Negro males, similar to previously described sample of White males.
Maresh and Washburn (1938)	81.8	33	80.7	26	See Table VIIIa.
Iowa Child Welfare Research Station (1931)	81.9	42	79.8	30	See Table VIIIa.
Peatman and Higgons (1938)	82.0	108	81.0	106	See Table VIIIa.
Simmons and Todd (1938)	82.2	152	80.6	149	See Table VIIIa.
Stuart (1934)	82.4	34	81.2	44	See Table VIIIa.
Baldwin (1921)	82.7	. . .	82.6	. . .	New York, probably White, "private cases furnished by Dr. Freeman."
Meredith (1935)	82.7	121			Iowa, 1926–34, over 90% North European, upper and middle classes, no symptoms of illness.
Boynton (1936)			82.2	71	Female counterpart of the foregoing male sample after Meredith.
Bayley and Davis (1935)	83.2	23	80.9	24	See Table VIIIa.
Boyd (1941)	83.2	17	82.2	5	See Table VIIIa.
Meredith (1940)	83.5	101	81.8	101	See Table VIIIa.
Mohr and Bartelme (1934)	84.0	5	80.0	7	Full-term infants representing "a slightly inferior socio-economic group," see Table VIIIa.

---

[1] See also Baldwin (1921).

[2] Supplied a diet of evaporated milk, orange or tomato juice, and vitamin D supplement. "Banana and cereal were started at 3 to 4 months, pureed vegetables and fruits at 5 and 6 months, and potato and meat at 8 to 10 months."

TABLE VIIIc

STATURE AT AGE EIGHTEEN MONTHS (Centimeters): Standard deviations, coefficients of variation, and selected percentiles for males, females, and both sexes together. See tables VIIIa and VIIIb for data on the size and leading characteristics of each sample.

Investigator	Standard Deviation	Coefficient of Variation	Minimum Value	Percentiles 10th	25th	75th	90th	Maximum Value
			MALES					
Stuart (1934)	2.6	3.2	78.9	79.1	80.5	83.9	85.5	90.0
Meredith (1940)	3.0	3.6	77.5	79.2	81.4	85.6	87.1	92.3
Woodbury (1921)[1]	4.3	5.3	61.0		77.5	82.4		99.0
Grandprey (1933)[2]				75.2			85.5	
Freeman (1933)	2.9	3.6	74.7					84.7
Bowditch (1872)			66.5					82.0
Maresh and Washburn (1938)			77.5					88.0
Gebhart (1924)	5.1	6.4						
Iowa Child Welfare Research Station (1931)	2.8	3.4						
Bayley and Davis (1935)	3.4	4.0						
Simmons and Todd (1938)	3.0	3.7						
Peatman and Higgons (1939)	2.8	3.4						
Boyd (1941)	2.3	2.8						

FEMALES								
Stuart (1934)	2.8	3.4	74.0	77.6	79.5	83.1	85.0	87.0
Meredith (1940)	2.7	3.3	76.2	78.4	80.0	83.6	85.5	89.4
Woodbury (1921)[1]	4.2	5.4	61.0		76.0	81.0		94.0
Grandprey (1933)[2]				73.7			83.7	
Freeman (1933)	5.1	6.5	64.2					84.6
Boynton (1936)	2.4	2.9	76.2					86.7
Bowditch (1872)			63.5					79.0
Maresh and Washburn (1938)			75.0					85.0
Gebhart (1924)	7.1	9.0						
Iowa Child Welfare Research Station (1931)	3.6	4.5						
Bayley and Davis (1935)	2.9	3.5						
Simmons and Todd (1938)	3.1	3.8						
Peatman and Higgons (1939)	3.2	4.0						
Boyd (1941)	2.8	3.4						
BOTH SEXES								
Bayley and Davis (1935)	3.3	4.0	73.5	78.1	80.0	84.3	87.1	88.5

---

[1] Based on the "Children's Year" data for White infants of all ethnic subgroups and geographic regions.

[2] The same data were employed as for the preceding study by Woodbury.

TABLE IXa

STATURE AT AGE TWO YEARS (Centimeters): Central tendency (mean or median) values from forty-two analyses of data on infants of both sexes. Each value is supplemented with an itemization of major characteristics of the sample.

Investigator	Average	Cases	State	Period	Ancestry	Other Characteristics of Sample
Hrdlicka (1941)	79.9	4	Alaska	1928–1931	Eskimo	Infants living in "Kuskokwin region" under "semicivilized" conditions.
Macy (1912)	81.3	c.100	Probably New York	Before 1912	. . .	Sample considered representative for two years of age.
Woodbury (1921)	81.5	1129	New York and others	1918–1919	Italian	All mothers born in Italy, socio-economic status probably below average.
Woodbury (1921)	82.3	373	Southern and eastern	1918–1919	Negro	Considered to represent a socio-economic level somewhat below average.
Blatt and Schapiro (1935)	82.4	c.20	Illinois	1931–1933	Mainly White, few Negro	Institutionalized, "in good health," fed a special diet during previous 6 weeks to 12 months.[1]
Rude (1922)	82.6	281	Indiana	1918	Mainly Slavic and British	Annual income below $1500 for 60%; data obtained at health conferences.
Holt (1897)	82.8	. . .	New York	Before 1897	Probably White	The data were probably accumulated in private practice.
Woodbury (1921)	82.8	994	New York	1918–1919	White	Predominantly of Italian and Jewish descent, parents only 23% native-born.
Mohr and Bartelme (1934)	83.3	62	Illinois	1929–1933	White, 60% North European	Premature infants (1000–2500 gm. at birth), from "a slightly inferior socio-economic group," given "excellent" postnatal care and supervision.
Benedict and Talbot (1921)	83.4	8	Massachusetts	1915–1917	White	"Offspring of normal resident wet-nurses," mostly breast-fed, "clinically normal."

Blatt (1921)	83.6	25	Illinois	. . .	Jewish	From a district in which "hygienic" and "dietetic" conditions were "decidedly adverse," nontuberculous cases.
Blatt and Schapiro (1935)	83.7	c.20	Illinois	1931–1933	Mainly White, few Negro	Institutionalized, "in good health," fed a special diet[1] with cereal of enriched mineral content for 6 to 52 weeks.
Coppoletta and Wolbach (1933)	84.0	20	Massachusetts	1914–1929	. . .	Cadavera—not considered premature, physically abnormal or diseased.
Woodbury (1921)	84.2	5122	Numerous	1918–1919	White	Predominantly from eastern and north-central states, North European stocks.
Woodbury (1921)	84.3	538	California	1918–1919	White	Parents 62% native-born, infants free from gross defect and signs of illness.
Holt and Howland (1926)	84.5	. . .	New York, Maryland (?)	. . .	Probably White	"Healthy" infants, probably "private pediatric practice" cases.
Woodbury (1921)	84.6	345	Several	1918–1919	German	Mothers born in Germany, no infants showing symptoms of sickness included.
Woodbury (1921)[2]	84.6	1213	Iowa	1918–1919	Mainly North European	Parents 82% native-born, infants free from gross defect and signs of illness.
Freeman (1933)	84.9	80	New York	. . .	White	Enrolled at nursery school of Institute of Child Development, Columbia Univ.
Grover (1915)	85.0	16	Massachusetts	Before 1915	Probably White	Mostly "out-patients," some "private" cases, some "bed patients," all "normal," measured in dorsal recumbency.
Wissler (1911)	85.2	5	South Dakota	Before 1911	American Indian	Full-bloods, "chiefly of the Ogallala subdivision of the Teton."
Crum (1916)	85.3	361	Numerous	1913–1916	Mainly North European	Infants measured at baby contests and health conferences.
Woodbury (1921)	85.3	360	Several	1918–1919	Scandinavian	Mothers born in Norway, Sweden or Denmark; infants free from illness.

IXa

TABLE [redacted]—(Continued)

INVESTIGATOR	AVERAGE	CASES	STATE	PERIOD	ANCESTRY	OTHER CHARACTERISTICS OF SAMPLE
Holt and Howland (1919)	85.6	. . .	New York, Maryland (?)	Before 1919	Probably White	"Healthy" infants, probably "private pediatric practice" cases.
Iowa Child Welfare Research Station (1931)	85.9	65	Iowa	1920–1929	Mainly North European	Data obtained in various urban areas of east-central Iowa.
Simmons and Todd (1938)	86.8	322	Ohio	1931–1937	North European	80% from upper classes, "healthy," under "efficient" medical guidance, stature measured erect but "not against a wall."
Wilson, Sweeny, Stutsman, Chesire and Hatt (1930)	87.1	56	Michigan	1922–1929	White	From "all" economic levels with "the upper levels . . . predominant," stature measured in the erect position.
Maresh and Washburn (1938)	87.1	55	Colorado	1932–1937	North European	Mainly from middle and upper classes, characterized as "average healthy."
Baldwin (1921)	87.2	. . .	New York	. . .	Probably White	Data on "private cases furnished by Dr. Freeman."
Stuart (1934)	87.2	57	Massachusetts	1930–1934	North European	Mainly middle classes, 50% Irish descent, none "sick," advised on diet and health care, measured in recumbent position.
Peatman and Higgons (1938)	87.3	209	New York and Connecticut	. . .	White	Annual income over $3000 for 60%, given "reasonably optimal" diet and health care from birth,[3] measured recumbent.
Bayley and Davis (1935)	87.4	43	California	1928–1931	Mainly North European	Mean family income $2844 yearly, subjects reasonably healthy and well nourished, measurements taken erect.
Gray and Ayres (1931)	87.5	42	New York and others	. . .	White	Majority of North European descent, socio-economic level "superior," characterized as "normals in private schools."

Wilson, Sweeny, Stutsman, Chesire and Hatt (1930)	87.6	54	Michigan	1922–1929	White	From "all" economic levels with "the upper levels . . . predominant," stature measured in dorsal recumbency.
Meredith (1935) and Boynton (1936)	87.8	175	Iowa	1926–1935	Mainly North European	Over 50% from professional and managerial classes, stature measured erect.
Boyd (1941)	88.0	16	Minnesota	. . .	Probably White	Subjects probably drawn from the upper and middle classes exclusively.
Freeman (1914)	88.1	c.30	New York	Before 1914	Probably White	"Well-cared-for," under pediatric guidance for diet, rest, fresh air and exercise.
Meredith (1940)	88.1	177	Iowa	1930–1939	North European	Drawn exclusively from the professional and managerial classes, stature erect.
Johnson (1925)	88.4	12	New York	1919–1923	White	From homes somewhat above average in socio-economic status.
Sawtell (1929)	88.4	22	New York	1925–1927	White	From homes of "moderate prosperity," infants measured in dorsal recumbency.
Wallis (1931)	88.4	46	New York	1924–1929	White	Parents 90% native-born, economically of "the favored class," recumbency data.
Mohr and Bartelme (1934)	88.5	5	Illinois	1929–1933	White	Full-term infants from "a slightly inferior socio-economic group."

---

[1] This consisted of whole milk, dextrimaltose, orange juice, cod liver oil, cereal, soups, vegetables, eggs, puddings, stewed fruits, bacon, and other foods. The subjects were "observed for periods varying from 6 weeks to 1 year."

[2] See also Baldwin (1921).

[3] This included orange juice and cod liver oil from four weeks, cereal from third month, egg yolk and strained vegetables from fourth, liver from sixth, custard from seventh. Ultra-violet radiation was prescribed during the winter months, also "diphtheria toxoid at the age of 8 months, a Schick test at 12 months, pertussis vaccine (Sauer) at from 12 to 15 months."

TABLE IXb

STATURE AT AGE TWO YEARS (Centimeters): Mean or median values for infants of each sex.

INVESTIGATOR	AVERAGE	NUMBER	AVERAGE	NUMBER	MAJOR CHARACTERISTICS OF SAMPLE
	MALES		FEMALES		
Woodbury (1921)	82.2	582	80.8	547	"Children's Year" data, mothers born in Italy, many from lower classes, see Table IXa.
Holt (1897)	82.8	. . .	82.8	. . .	See Table IXa.
Mohr and Bartelme (1934)	82.8	32	83.9	30	Premature infants, see Table IXa.
Woodbury (1921)	82.9	184	81.8	189	Negro infants, socio-economic level considered below average, see Table IXa.
Rude (1922)	83.0	162	82.0	119	See Table IXa.
Benedict and Talbot (1921)	83.4	4	83.4	4	See Table IXa.
Woodbury (1921)	83.4	480	82.3	514	New York City residents, White, see Table IXa.
Blatt (1921)	83.8	13	83.3	12	See Table IXa.
Swanson (1926)			83.3	45	Minnesota, 1924–25, parents mainly North European descent and "middle class," infants full-term, "healthy normal."
Woodbury (1921)	84.9	2638	83.4	2484	"Children's Year" data on White infants from all regions and ethnic subgroups studied.
Woodbury (1921)	85.1	170	84.2	175	Mothers born in Germany, see Table IXa.
Holt and Howland (1926)	85.1	. . .	83.8	. . .	See Table IXa.
Woodbury (1921)[1]	85.4	643	83.7	570	"Children's Year" data, residents of Iowa, White, see Table IXa.
Grover (1915)	85.6	10	84.2	6	See Table IXa.
Freeman (1933)	85.6	40	84.1	40	See Table IXa.
Crum (1916)	85.7	201	84.8	160	See Table IXa.
Woodbury (1921)	85.8	260	82.9	278	Residents of California, White, see Table IXa.
Rhoads, Rapoport, Kennedy and Stokes (1941)	85.8	134			Pennsylvania, 1936–40, White, mainly "lower income groups," supervised from 6 weeks.[2]
Woodbury (1921)	86.1	189	84.4	171	Mothers born in Norway, Sweden or Denmark; see Table IXa.
Holt and Howland (1919)	86.3	. . .	84.8		See Table IXa.
Rhoads, Rapoport, Kennedy and Stokes (1941)	86.4	99			Pennsylvania, 1936–40, Negro males, similar to previously described sample of White males.

Wise (1941)			85.1	25	Alabama, 1939–41, White, mean annual income $670 yearly, infants measured erect.
Iowa Child Welfare Research Station (1931)	86.5	30	85.3	35	See Table IXa.
Wissler (1911)			85.5	4	See Table IXa.
Simmons and Todd (1938)	87.4	157	86.2	165	See Table IXa.
Wilson, Sweeny, Stutsman, Chesire and Hatt (1930)	87.6	29	86.6	27	Stature measured with subjects in the erect position, see Table IXa.
Maresh and Washburn (1938)	87.6	30	86.4	25	See Table IXa.
Baldwin (1921)	87.8	...	86.6	...	New York, probably White, "private cases furnished by Dr. Freeman."
Wilson, Sweeny, Stutsman, Chesire and Hatt (1930)	88.1	29	87.1	25	Stature measured with subjects in the recumbent position, see Table IXa.
Peatman and Higgons (1938)	88.1	101	86.6	108	See Table IXa.
Bayley and Davis (1935)	88.4	24	86.1	19	See Table IXa.
Stuart (1934)	88.5	26	86.1	31	See Table IXa.
Meredith (1935)	88.5	104			Iowa, 1926–34, over 90% North European, upper and middle classes, no symptoms of illness, measurements taken in erect position.
Boynton (1936)			86.9	71	Female counterpart of the foregoing male sample after Meredith.
Boyd (1941)	88.5	12	87.2	4	See Table IXa.
Meredith (1940)	88.9	105	87.2	72	See Table IXa.
Sawtell (1929)	89.5	11	87.2	11	See Table IXa.
Johnson (1925)	89.6	5	87.3	7	See Table IXa.
Gray and Ayres (1931)	89.6	21	85.4	21	See Table IXa.
Wallis (1931)	89.9	24	86.7	22	Sample apparently included many of same records as used by Sawtell (1929) and by Gray and Ayres (1931), see Table IXa.
Mohr and Bartelme (1934)	91.7	3	85.0	2	Full-term infants, see Table IXa.

---

[1] See also Baldwin (1921).

[2] Supplied a diet of evaporated milk, orange or tomato juice, and vitamin D supplement. "Banana and cereal were started at 3 to 4 months, pureed vegetables and fruits at 5 to 6 months, and potato and meat at 8 to 10 months."

TABLE IXc

STATURE AT AGE TWO YEARS (Centimeters): Standard deviations, coefficients of variation, and selected percentiles for males, females, and both sexes together. See Table IXa and IXb for data on the size and leading characteristics of each sample.

INVESTIGATOR	STANDARD DEVIATION	COEFFICIENT OF VARIATION	MINIMUM VALUE	PERCENTILES				MAXIMUM VALUE
				10TH	25TH	75TH	90TH	
			MALES					
Stuart (1934)	2.8	3.2	83.5	84.6	86.2	90.4	91.7	96.7
Meredith (1940)	3.3	3.8	81.3	84.6	86.8	90.7	93.4	98.0
Woodbury (1921)[1]	4.2	4.9	69.0		82.2	87.4		107.0
Grandprey (1933)[2]				79.8			90.2	
Wilson, Sweeny, Stutsman, Chesire and Hatt (1930): Erect			79.7	83.5	85.8	89.2	90.9	94.2
Recumbent			81.0	84.5	86.4	89.7	92.2	95.7
Wallis (1931)	3.5	3.8	80.0					96.0
Freeman (1933)	4.3	5.0	72.1					91.4
Johnson (1925)			85.1					93.5
Maresh and Washburn (1938)			84.5					93.4
Sawtell (1929)	3.0	3.3						
Gray and Ayres (1931)	3.7	4.1						
Iowa Child Welfare Research Station (1931)	3.6	4.1						
Bayley and Davis (1935)	3.3	3.7						
Simmons and Todd (1938)	3.2	3.7						
Peatman and Higgons (1939)	3.3	3.8						
Boyd (1941)	2.5	2.8						

FEMALES								
Stuart (1934)	2.9	3.4	80.0	82.0	84.6	88.1	89.7	92.2
Meredith (1940)	2.8	3.2	81.1	83.3	85.5	89.3	90.8	92.6
Woodbury (1921)[1]	4.0	4.8	69.0		80.8	85.9		104.0
Grandprey (1933)[2]				78.5			88.6	
Wilson, Sweeny, Stutsman, Chesire and Hatt (1930): Erect			79.2	81.7	85.7	88.7	90.4	93.2
Recumbent			80.5	83.5	84.4	88.3	90.4	92.4
Wallis (1931)	2.7	3.1	83.0					92.0
Freeman (1933)	4.4	5.3	73.7					92.3
Boynton (1936)	2.8	3.2	79.0					93.9
Johnson (1925)			84.6					91.9
Maresh and Washburn (1938)			81.3					91.8
Wise (1941)	3.8	4.5	78.6					90.4
Sawtell (1929)	3.4	3.9						
Gray and Ayres (1931)	3.3	3.9						
Iowa Child Welfare Research Station (1931)	3.8	4.4						
Bayley and Davis (1935)	2.0	2.4						
Simmons and Todd (1938)	3.2	3.7						
Peatman and Higgons (1939)	4.0	4.6						
Boyd (1941)	3.0	3.4						
BOTH SEXES								
Bayley and Davis (1935)	3.0	3.4	81.0	83.3	84.9	88.9	91.4	94.0

S.C.E.R.T., West Bengal
Library

---

[1] Based on the "Children's Year" data for White infants of all ethnic subgroups and geographic regions.
[2] The same data were employed as for the preceding study by Woodbury.